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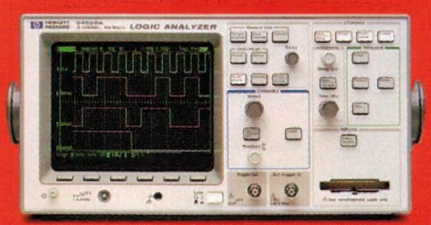

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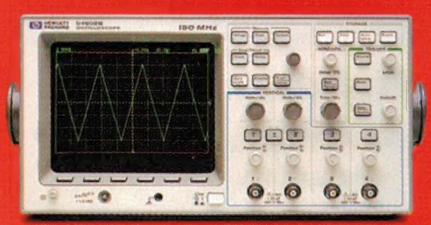

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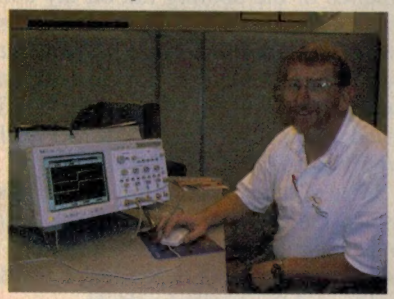
Electronics

AUSTRALIA with Professional Electronics & ETI

Volume 59, No.9
September 1997

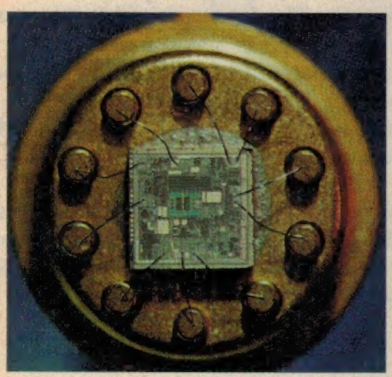
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

New scopes from HP



Hewlett-Packard has just released a family of high-end digital scopes, the 'Infinium' series, which set a new standard in user friendliness. Along with intuitive front panel controls they offer a fully integrated 'drag and drop' graphical user interface based on Windows 95, plus a comprehensive online help system. See our lead news story, on page 92.

Low cost accelerometer



Analog Devices' ADXL05 accelerometer chip can be put to work fairly easily, as Graham Cattley shows in his article starting on page 64.

On the cover

Casio's new Cassiopeia handheld computer can be used 'on the road' with a PCMCIA modem for web surfing and other Internet activities. Graham Cattley reviews it in this issue, starting on page 26. (Photo by Ben Granger). Jim Rowe also reviews the Olympus C-800L digital still camera, starting on page 14.

World of Electronics

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ELECTRONICS AUSTRALIA is published by Federal Publishing Company, a division of Eastern Suburbs Newspapers Partnership, which is owned by
General Newspapers Pty Ltd.
A.C.N.000 117 322,
Double Bay Newspapers Pty Ltd.
A.C.N.000 237 598, and
Brehmer Fairfax Pty Ltd.
A.C.N.008 629 767,
180 Bourke Road, Alexandria, NSW 2015.

Printed by Macquarie Print, 51 - 59 Wheelers Lane, Dubbo 2830. Phone (068) 843 444.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Rd, Alexandria 2015; phone (02) 9353 9911.
ISSN 1328-6218
* Recommended & maximum Australian retail price.

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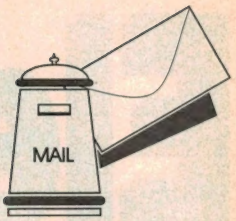
LETTERS TO THE EDITOR



DSS supplier?

I am writing in the hope that you can supply the postal address of an American manufacturer of Digital Satellite Systems (DSS).

I recently read your June issue of *Electronics Australia* and found the news item on page 108 very interesting. I wish to know more about the subject and the hardware, e.g. the 18" mini-dish and decoding equipment etc.

The reason for an American address is that I assume that this technology hasn't yet reached our shores — unless you know differently. If there is an Australian company that can help I would like their address too.

Leigh Hauber
Glandore, SA.

As we understand it digital DSS technology hasn't quite reached Australia yet, Leigh. One of the first making and selling the receiving equipment in the USA is RCA/Thomson, so perhaps you can find more information on the Web.

Wrong tower?

Having read your 'Forum' in *EA* of May 1997 I was motivated to resurrect a device which I obtained in the early eighties. It is basically a gaussmeter designed to measure magnetic field strengths relative to field coils used with magnetic therapy apparatus in medical clinics. As such, it is uncalibrated and relies on the voltage induced in an iron cored solenoid to provide base current through a resistive divider to drive a series of ten LEDs via transistors. The device does not appear to be very sensitive and requires quite a strong magnetic field to exhibit a visible response.

In the early eighties I was employed by the major power generation authority in New South Wales and, while there, took the opportunity to 'check out' one of their older generation establishments with the above apparatus.

In very few locations did the device register at all and the highest reading (about five LEDs activated) was obtained near large DC motors used to drive emergency oil pumps in the event of an AC supply failure. Cables and busbars carrying up to 132kV failed to elicit any response from the device when tested at normal safe working distances.

Imagine my surprise then, when the device registered a full scale reading when brought within two or three centimetres of the cooling fan on my computer's SMPS. Further exploration revealed similar results from a plugpack used to power a modem (the modem was switched off at the time) and a line filter/conditioner which is installed in the supply to all these devices.

Subsequent experiments have confirmed the presence of these ELF fields in the vicinity of similar apparatus and at varying frequencies dependent upon the design and the applied voltage.

I am familiar with the work of Drs Burr, Becker, Adey etc. and now begin to wonder if we are, perhaps, 'barking up the wrong transmission tower' in our quest for a solution to the link between ELF fields and human health.

Ron Williams
Kin Kin, Qld.

Handy web site

Re the article titled 'Specs In Secs: IC Data On The Internet' in the July issue of *EA* by Darren Yates, pages 96 - 97. A site that contains all the info plus much more is The Semiconductor Subway at **http://www-mtl.mit.edu/semisubway.html.**

The Maker/Vendor Subway at **http://www-mtl.mit.edu/cgi-bin/-Mapgen/vendor_subway** accessed from here is what most electronics hobbyists need.

Anthony J. Hagen
Glenhuntly, Vic.

Help with kits

I believe there might be a need for some of your readers requiring help with electronic kits, so I would just like to let your readers know that I am available and offer my services to build or repair their electronic kits. I have many years experience in the electronic industry including a Diploma in Electronic Engineering. I have built many projects in the past and have a good workshop set-up. So if any of your readers need help with their kits just let me know and I will see if I can help them.

I can be contacted by email at

Gliney@ois.net.au or by post at PO Box 857, Hillarys 6923; phone (089) 307 8213 or mobile (014) 88 0557. I also have an Internet home page at **http://ois.net.au/~gliney/index.html**.

Well done on your magazine. I am an avid reader and always look forward to every issue. I have been a subscriber to your magazine since 1994.

Gary Liney
Hillarys, WA.

Additional info

With regard to Roger Johnson's Vintage Radio column 'Battery-Powered Valve Sets' (*EA* June 1997), I would like to make two comments:

1. His description of the 'Pentagrid 4' superheterodyne in *Wireless Weekly* of 25th May 1934 refers to a number of anachronisms, but omits to point out that the filament rheostat for the type 32 IF amplifier is in fact the gain control for the receiver. (Control of filament temperature to vary gain was frequently used in early receivers.)
2. Whilst both US and European manufacturers contributed major improvements to valve design in the early days of radio, it is of considerable interest to remember that quite large numbers of battery operated neutralised-triode TRF receivers imported into Australia from the US were equipped with valves of the A209, A409 and A609 series made by Philips in Holland.

Winston T. Muscio
Leumeah, NSW.

More on micros

Congratulations on an excellent read! I discovered *EA* only by chance — from a stack of second hand issues destined for the tip. I guess I did my bit for recycling, and ever since I look forward to each new issue. I am particularly interested in the latest computer developments, and would like to hear more about applications for microcontollers, such as the 'BASIC Stamp'.

However, being a novice electronic enthusiast I find some of the reviews a little confusing, and would very much appreciate a one-page tutorial dealing with a different topic each month. Keep up the good work!

Greg Arnoldussen
Cheshunt, Vic. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT

The risks of taking technology for granted

It's especially easy for those of us with an interest in science and technology to become blasé, and take the achievements in these areas for granted. I was reminded of this by two recent experiences which are nominally quite different, but in fact linked by a common thread.

The first was my reading of the book *Longitude*, by Dava Sobel (Fourth Estate, London; ISBN 1-85702-502-4) — the fascinating story of 18th-Century British clockmaker John Harrison, and his 40-year quest to produce a nautical timekeeper accurate enough to allow mariners to determine their longitude to within 30 nautical miles. Dava Sobel's writing really makes you realise the significance of Harrison's achievement, when he finally demonstrated his H-4 chronometer in 1762. To create a hand-made mechanical timekeeper which remained accurate to within two minutes, after five months of voyaging on two small sailing ships, really was an incredible achievement, considering the modest technology available at the time.

Yet at the same time, I couldn't help but be struck by the progress that has been made in the development of technology to measure time and frequency, in the intervening 235 years. It's sobering to realise, for example, that you can now buy a quartz crystal watch with an accuracy and stability better than Harrison and his immediate successors could produce, for less than $20!

The second experience, which really drove this home to me, came a couple of weeks ago when I was visiting the Hewlett-Packard facility in Santa Clara, California, as part of a quick tour of their Test & Measuring Operation divisions (more about this next month). I was lucky enough to be able to visit the departments where HP makes and tests its world famous HP 5071A cesium-beam time and frequency standards, and also the nearby areas where they make their latest high-stability crystal oscillators, as used in many of their current test instruments.

Frankly, this part of the tour almost blew my mind, especially when I realised that even the 'standard' version of the current-model HP 5071A delivers an accuracy of two parts in 10^{12} and a time-domain stability of better than five parts in 10^{14}, over a 30-day period. Roughly speaking that translates to at least *10 million times* the accuracy and stability of Harrison's H-4 — so we've come quite a long way, haven't we?

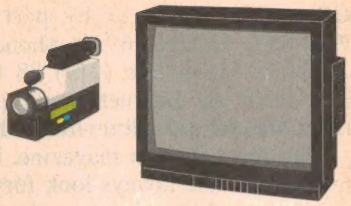
Time and frequency are now the most accurately defined and measurable basic units of all, thanks to the work of engineers at firms like Hewlett-Packard. And this has brought great benefits to society — like the use of the Global Positioning System for accurate location of ships, planes and even lost bush walkers or taxi cabs.

So next time you see a story in *EA* or some other magazine about the latest technology, try to put it into perspective. We've seen so many developments in recent years that it's all too easy to take them for granted, and not give due credit to what has been achieved — and is still being achieved...

Jim Rowe

WHAT'S NEW

IN THE EVER-CHANGING WORLD OF ELECTRONICS



CTV automatically sets picture values

LGE's new 'Golden EYE' television automatically adjusts its screen picture according to the conditions of the television's surroundings, for optimum viewing. The set uses state-of-the-art technology developed and patented by LGE to analyse the brightness and light in any room. It then adjusts the picture brightness, sharpness, contrast, and colour saturation accordingly.

LGE says the set also incorporates a new dimension in picture tube technology — a 'super-flat' picture tube, claimed to provide distortion-free viewing even along the edges. This is claimed to offer a richer visual effect, with greater realism and clarity and fewer reflections.

The 'Golden EYE' also provides the sound retrieval system (SRS), allowing viewers to enjoy a surround-sound effect without the need for additional speakers. A built-in 'super woofer' sound system also enhances the experience through the dynamic reproduction of deep bass sounds.

The new receiver should be available from all LGE dealers.

VAF's new Signature I-93 'flagship' system

South Australia's hifi loudspeaker designer and manufacturer VAF Research has released its new Signature I-93 'flagship' system, described as a true no-compromise speaker. The system uses a time-aligned five driver symmetrical vertical array in each enclosure, with Sonotex 25mm double-chamber dome tweeters using pure silver wire voice coils, two 130mm magnesium cone midrange drivers and two 210mm hard paper cone woofers, the latter both fitted with solid copper phase plugs. "They are the most advanced production drivers in the world today", says VAF Research's MD Philip Vafiadis.

Almost half the internal wiring of the Signature I-93's is pure silver, and the rest (including the massive crossover inductors) is oxygen-free copper (OFC). The cabinets are made from MDF and feature fully mitred construction and substantial bracing. The baffles are laminated MDF to 52mm. Standard finishes include very high quality piano gloss or satin lacquer on crown cut and matched European Beech or Santos Palisander veneers.

Rated frequency response of the Signature I-93 system is 17Hz - 21kHz (21Hz - 19kHz +/-1.2dB), with a sensitivity of 89dB/W at 1m and a phase response of +/-5% from 100Hz to 20kHz. The nominal impedance is 3Ω, which is stable and non-reactive. The system is suitable for amplifiers with output levels from 10W to 500W RMS. Each enclosure measures 1515 x 270 x 491mm, and a pair weigh 200kg.

Each fully assembled Signature I-93 system is provided with bound, individually measured Performance Verification documents confirming their accuracy. The speakers are only available directly from VAF Research, as either fully assembled systems or ready to assemble kits. Prices range from $4150 to $8000 per pair.

For further information circle 141 on the reader service coupon on contact VAF Research at 291 Churchill Road, Prospect 5082; phone (08) 8269 4446, fax (08) 8269 4460 or freecall 1800 81 8882. VAF also has a Web site at **www.VAF.com.au**.

Compact active monitor speakers

The new Spirit Absolute 4P active monitors are claimed to deliver all of the elements desired by audio professionals: natural, uncoloured sound, even frequency and accurate time domain response. Designed by Trevor Stride, the man behind the acclaimed Absolute 2 and Absolute Zero monitors, the Absolute 4Ps are said to offer 'absolute quality'.

Two 100-watt amplifiers in each enclosure (one for HF, the other for LF) make it the most powerful active monitor in its price class. Employing bass cones which are both lighter and more rigid than standard designs, the 4Ps are said to be at least 2dB more efficient, while the newly designed tweeters and 'intelligent' driver system give maximum undistorted output while maintaining flat on- and off-axis frequency response.

A 'true phase linear' design electronically aligns the drivers and prevents phase lag, ensuring that all frequencies reach your ear at the same time — essential for accurate sound monitoring.

The Absolute 4P monitors are also user-friendly, with operating status continuously monitored by a zero colouration active circuit. Any signal approaching danger level is progressively limited by precision electronic attenuation, without affecting transients. A 'protect' LED on the front panel alerts users to the limiter's operation, giving you visual indication to turn the signal down.

Other features include a constant voltage active crossover, stepped input level control for accurate setup and switched 40Hz HPF.

For further information circle 145 on the reader service coupon or contact Jands Electronics, 40 Kent Road, Mascot 2020; phone (02) 9582 0909 or fax (02) 9582 0999.

Pocket-sized digital camera from Toshiba

Toshiba Corporation in Japan has announced its new Allegretto PDR-2, a pocket-size compact colour digital still camera with built-in PC card. The PC card plugs into a PC card (PCMCIA) slot, allowing the user to view images on the computer's screen or download easily without the need of using an optional serial cable for connection. This convenience cuts the time from shooting to image viewing and editing on a PC.

The PDR-2 measures only 150mm wide, 55mm high and 20mm deep (excluding protrusions), and fits snugly into a shirt pocket. It weighs only 130g (excluding battery).

Unlike most other digital cameras the Allegretto also uses a CMOS image sensor, whose power consumption level is around 1/10 that of CCD image sensors currently in widespread use. Further, the camera's ultra-low power consumption design means that one battery provides enough power for shooting more than 500 pictures.

As a storage medium, it uses the stamp-size SmartMedia 3.3V memory card, which has a thickness of 0.76mm.

Resolution of the camera's 6mm CMOS image sensor is 330,000 pixels, and it takes 640 x 480 pixel (VGA) images. The images are stored in the camera in JPEG (exif) compressed format, in either 'Fine' or 'Standard' mode. Up to 24 Fine images can be stored in a 2MB memory card, or 48 Standard mode images.

The lens used in the PDR-2 has a focal length of 4.9mm, with a field of view equivalent to a 49mm lens on a 35mm camera. It provides a maximum aperture of f/2.8, and is fitted with an automatic mechanical shutter with a speed range of 1/8 - 1/1000 second. The viewfinder is of the optical real image type. Power consumption is only 2.4W from the 3V lithium-ion battery.

The price of the PDR-2 camera in Japan is 59,800 yen.

HP's first Deskjet printing on A3 paper

Hewlett-Packard, world's leading supplier of printers and scanners, has introduced the HP DeskJet 1000Cxi Professional Series inkjet printer, its most versatile printer yet for small-business customers. The new printer, which has an estimated street price of $849 including sales tax, is HP's first DeskJet printer that can print on various media, from 10.16 x 15.24cm post cards to A3-size paper.

Bundled with the 1000Cxi is easy-to-use software with features including 'HP ZoomSmart' scaling technology, said to take the hassle out of formatting documents and customising page sizes. Users simply work on a document as usual and use HP ZoomSmart to enlarge or reduce it to the desired print size, with no loss of resolution. The 1000Cxi can also be used to create extra large posters, up to 1.2 metres high, and banners. It provides a reverse-imaging feature to accommodate such applications as iron-on transfers, and a booklet feature which allows customers to print catalogs and booklets paginated in the proper order automatically on any size paper, with manual duplex printing.

The HP DeskJet 1000Cxi printer prints up to six pages per minute (ppm) in black text and 3.5ppm in colour. It gives crisp black text at 600 dots per inch (dpi) with HP Resolution Enhancement technology (REt) and colour at 600dpi with Color Resolution Enhancement technology (C-REt). HP's RealLife Imaging System is claimed to automatically deliver vivid colours and sharp black text on plain paper.

The new printer is Microsoft plug-and-play-ready for Windows 95 and supports Windows 3.1x. It comes with a one-year, limited warranty. For further information call HP's toll-free Customer Information Centre on 131347, from anywhere in Australia.

Hi-res thermal camera from Mitsubishi Electric

Mitsubishi Electric has released what it claims is one of the world's highest resolution thermal imagers in mass production, capable of producing sharp, clear images at a distance of up to two kilometres. With ultra high 801 x 512 resolution, yielding more than 410,000 pixels, the imager's display quality is equivalent to that of a standard television.

Highly sensitive to minute temperature differences of less than 0.15°C, the IR-M700 has a novel cooling system. Typically, cooling systems used for infrared imaging use liquid nitrogen or high pressure gas, meaning they cannot be operated continuously or moved to different locations.

Mitsubishi has developed a cryogenic Stirling-cycle cooler which can be used anywhere at any time and has a lifetime of up to 6000 hours. More accurate than other cooling systems, the unit uses one watt to cool the imager to -321°F.

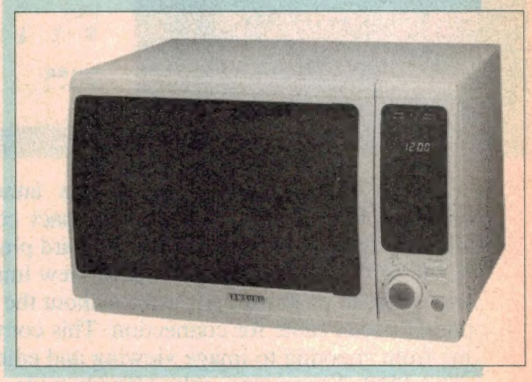
Ease of portability is ensured because the image processing module is integrated with the IR sensor and cooling module into one single, compact body. The unit is smaller than other models and weighs just 1.9 kilograms. Because it is equipped with a palm-sized wired remote control device, the camera can be installed anywhere and operated easily from a distance of up to 200 metres.

Applications for this light, compact thermal imager include surveillance for air, sea or ground search and rescue, customs operations, alarm systems, industrial use such as monitoring factory machinery at a distance, and research and development into areas such as monitoring volcanoes and studying nuclear power.

Samsung's novel new 'up & down' microwave

How could you improve on modern microwave ovens? Samsung Electronics has found a way, and is describing its new 'Elevation Wave' oven (just released in the USA) as 'revolutionary'. The new model has an elevating turntable that raises and lowers food as it cooks, to insure more uniform cooking.

As yet the MG6876W Elevation Wave model is the only microwave oven to use this technology, claimed to provide tastier and better cooked food in less time. The oven has a capacity of 31 litres (1.1ft^3) and is equipped with an automatic gas sensor that calculates cooking time by food type and by efficiently monitoring emitted vapours and gases. It provides 11 instant cook settings, 10 power levels, a 1300W grilling function for browning meats; and a ceramic coated oven cavity for even cooking and easier cleaning.



Vass releases BIG electrostatic speaker system

Victorian firm Vass Electronics, formerly known for its design and manufacture of power supply and OEM equipment, has released the first of three new models of electrostatic speakers.

The ELS2 is a huge floor standing electrostatic system with an integral subwoofer enclosure. The system measures 810 x 450 x 1740mm (W x D x H) and has a total weight of 90kg. It has three separate angled electrostatic arrays with a node structure to optimise both the polar dispersion and the frequency response. The three arrays use an 11-micron thick mylar film charged to 3kV (kilovolts).

The subwoofer handles frequencies below 150Hz via an 18dB/octave crossover that drives two 10" carbon fibre woofers in a 50-litre infinite baffle enclosure. The crossover has a boost of 12dB/octave for frequencies below 60Hz to ensure a flat response down to 30Hz.

The ELS2 system is claimed to successfully combine the legendary transparency, clarity and transient response of electrostatic dipoles with the deep 'tight' bass and wide polar dispersion of conventional speakers. Many custom selected wood finishes are available and each speaker is supplied with its own individually calibrated frequency response plot.

The ELS2 is not for the bargain hunter, however; it has a RRP of $15,000. Other models range from $9600 to $18,700. For further information circle 140 on the reader service coupon or contact Vass Electronics at 6/42-44 Garden Boulevard, Dingley 3172; phone (03) 9558 0970.

Solid speakers for home cinema sound

Progressive British company Solid, an offshoot of the well-known B&W Loudspeakers, has come up with a range of new speakers that are claimed to satisfy the most demanding movie buffs, as well as finicky music lovers. A feature of the new Solid Solutions range is enclosures moulded from a special polypropylene material, providing a cabinet structure that is both reasonably light and very rigid.

Heart of the new series is the nicely sculpted model S100 speaker, designed for both movie and surround sound reproduction. It's a speaker said to be equally at home on its dedicated stand or in a bookshelf, as it is when placed on a wall or in a corner.

Equally attractive and functional is the C100 centre speaker, designed to accurately reproduce the dialogue and some of the effects in movie sound tracks with both realism and excitement. The C100 is designed to be placed above or below the television so that important movie sounds are locked solidly to the on-screen action. It's also specially shielded so there's no interference with the TV picture.

Finally there's the compact yet powerful PB100 subwoofer, which makes the Solutions system a very versatile and sophisticated package. Although compact in size, so it can be placed inconspicuously in the home, this subwoofer is claimed to bring movies to life in home cinema situations with its sheer impact and the dynamic capabilities of the low bass it reproduces.

The PB100 includes a built-in 70-watt amplifier, using high speed MOSFET output devices in the output stage to provide improved clarity, power handling and overall bass performance.

The Solid Solutions S100, C100 and PB100 are available separately, for an RRP of $299/pair, $249 each and $499 each respectively. For more information circle 142 on the reader service coupon or contact Convoy International on Freecall 1800 251 995.

Panasonic's new mini hifi systems

Panasonic has released two new mini hifi systems, both with five-disc CD changer and 13-band spectrum analyser.

The highest featured of the two models is the SC-AK40, which has a powerful output of 100 watts (RMS) per channel. The second SC-AK20 model has 50W RMS per channel.

The 'airport-like' spectrum analyser display included on both models provides an easy way to confirm play and operation status. The 13-band spectrum analyser is represented by a pulsating light pattern which resembles an airport runway at night. There are five preset equaliser patterns (Disco, Hall, Live, Heavy, Clear and Soft), which allows users to select the sound most suitable for the sound source.

The two new systems have a five disc 'stacker-style' CD changer with Panasonic's 'Digital Servo' plus MASH single-bit technology to ensure outstanding sound quality and reproduction. Both systems also include dual cassette deck, AM/FM digital tuner and timer.

Panasonic has also developed a new '3D Space Sound' speaker system. A three dimensional sound field is provided, allowing listeners to enjoy stereo sound throughout the room. The SC-AK20 has a two-way speaker system while the SC-AK40 has a three-way system. Both models have a full function remote control.

The Panasonic SC-AK20 and SC-AK40 mini hifi systems are available from leading electrical retailers, with an RRP of $659 and $769 respectively. For further information circle 144 on the reader service coupon or contact Panasonic's Customer Care Centre on 132 600. ❖

CD player holds 25-disc 'library'

Pioneer's new 25-disc Discmaster player, the PD-F25, represents excellent value at only $199. This 'friendly little organiser' offers over 30 hours of uninterrupted music, and is claimed to be equally suited for home or commercial environments such as shops and restaurants. It's also suitable for parties and social activities that want hours of uninterrupted music.

The PD-F25 is designed to be 'heard and not seen', and connects simply to a spare CD or auxiliary input on your existing home hifi system. It holds 25 of your favourite CDs via Pioneer's innovative 25-disc Discmaster library, which allows up to 32 selections to be programmed for playing in any order. Music can also be played at random.

The PD-F25 also boasts three 'file' playback modes, Previous Disc Scan, Best Selection Memory, and Hi-Lite Scan. It employs Pioneer's 'favourite' single-bit Direct Linear Conversion Technology, for a 'natural and detailed' sound.

The PD-F25 is covered by a two-year parts and labour warranty and is available at selected Pioneer outlets. For further information circle 143 on the reader service coupon or contact Pioneer on 1800 060 852.

Video & Audio: The Challis Report

PHILIPS AND THE DEVELOPMENT OF DVD

Recently our reviewer Louis Challis had the opportunity to visit the Philips Research Laboratories in Eindhoven, Holland. One of the things he learned was the progress that has been made in the digital video and audio technology used in DVDs (digital video discs) — likely to be on sale here before the end of this year. Here's what he found...

Over the last year, like many other reviewers, I've been perplexed by successive changes in the industry's stated position as to what precise format will be adopted for DVD in Australia and New Zealand.

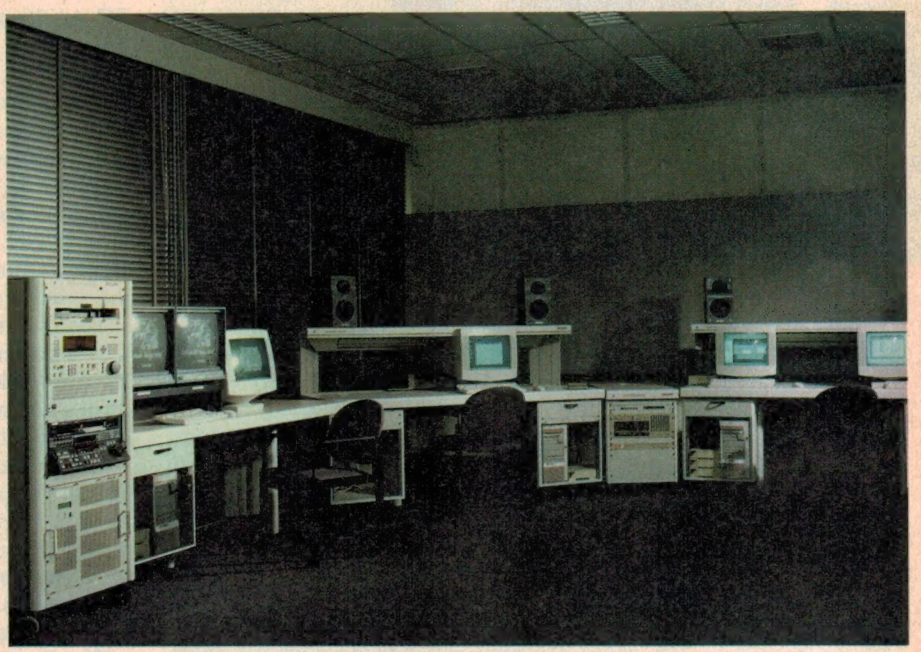
As late as December 1996, I was being assured that the future Australian DVD standard would be based on a Dolby Digital (AC3) sound system. But as time progressed, it became apparent that Australia's DVD format would in fact be based on 'MPEG2 Video and Audio Decoding', about which I knew pitifully little.

In attempting to discover what I did not know, I learnt that the people from whom I sought help knew little more than I did, and it appeared that it was a case of the 'blind leading the blind'. So when Philips were kind enough to invite me to visit Eindhoven for an in-depth briefing on DVD, I willingly accepted the invitation. It offered me a rare opportunity to 'kill two birds with one stone'. Firstly it would resolve my ignorance on 'MPEG2', as it would provide me with an opportunity to delve into an area about which I knew nought. Secondly it would provide me with an opportunity to find out more about the Philips organisation and where it is going.

Although the locals won't admit it, Eindhoven is a company town, or more precisely a vibrant city in the south of Holland, not far from the Belgian border. If it weren't for Philips' presence in the city for the last 106 years, Eindhoven might still be a village. Philips' lamp factories started production in Eindhoven in 1891. During the first 50 years of the company's existence, lamp production made the company's name, and was its pre-eminent product.

As you may appreciate, there are some very interesting parallels between a conventional glass light bulb and the earliest generations of radio valves. The similarity could not be ignored by Philips, who soon became involved in the manufacture and development of radio valves and related radio equipment in the early 1920s. By the late 1930s, they were already a major player in the field of consumer and professional radio equipment.

As World War 2 approached, Philips was already a major contributor to advanced research in radio technology, and the Eindhoven research laboratories were renowned throughout Europe for a continuous flow of new and innovative products, which were regarded as being 'state of the art'.



A general view of a Philips MPEG2 video and audio authoring studio, of the type now going into service for production of DVDs. (Courtesy Philips Electronics)

Immediately prior to the Second World War, Philips took the unprecedented step of sending its research laboratory staff to America in order to avoid the perceived dangers of an enemy invasion. At the time of the German invasion, Philips had already dismantled and was in the process of shipping out hundreds of truckloads of critical production equipment from its Eindhoven facility.

During the ensuing period, although Philips' factory continued production under German control, the Dutch staff were neither willing nor supportive of their German conqueror's needs or demands.

Having viewed American newsreels of that era, I am aware that films showing the bombing of the Eindhoven factory by American 'flying fortresses', described the targets as 'axis factories in Holland'. By the end of the war, much of Eindhoven, and particularly Philips' factories, had been virtually flattened by the allied bombing raids.

Following the end of hostilities, Philips reconstructed its facilities in Eindhoven, and by 1946 were back in production not only with light bulbs, but with a range of new products — which have now of course grown to the point where light bulbs no longer constitutes the basis for Philips' existence.

In the 50 years following the end of World War 2, Philips research laboratories have produced what must now be acknowledged as being some of the most outstanding consumer electronic developments of our era. They include the development of the compact cassette, laserdisc technology, and last but not least, CDs and the derivatives that have followed therefrom — CDi, CDV, CDR, CD ROM, and most recently DVD.

What is MPEG?

DVD of course combines most of the attributes of laserdiscs with the latest developments in CD technology, supplemented by advanced signal compression for both the audio and video signals.

My original question was "What exactly

is MPEG"? As I soon discovered, 'MPEG' is an abbreviation of 'Motion Picture's Expert Group'. MPEG was created by the International Standards Organisation and International Electro-Technical Commission, and was formed from a pre-existing Joint Photographic Expert's Group (JPEG) which had previously worked under the auspices of the IEC. The primary aim of the new group was to ensure that a single standard would be developed that would be suitable for encoding moving pictures and sound applicable to recording on standard digital storage media, or for broadcasting.

The media on which their efforts and attention really focussed were compact discs, optical media, magnetic media (large disc drives) and in the near future, solid state memories. As moving pictures are now almost always interlinked with accompanying soundtracks, MPEG also defines a standard for decoding the sound information.

The MPEG2 standard was a refinement on the MPEG1 standard, which I evaluated in a Philips CDI system with extensive software approximately two years ago. The problem with MPEG1, was that although it offered reasonable visual and sound quality, it was simply inferior to normal VHS video recordings, or existing TV services.

Any new composite video/audio standard which did not outperform and offer attributes beyond that which we already had, was clearly doomed to failure. MPEG1 was tarred with that brush, and was relegated to an 'also ran' status.

But why do we need MPEG, and what is the basis for the encoding that it offers?

Well, the basis of the MPEG encoding is to record the information embodied by the composite audio and video signals, using a fraction of the amount of the data storage space that was previously required by conventional data transmission, or storage systems. The critical term that describes what the MPEG system does is *encoding*, which in this situation is a synonym for *compression*.

The best example of what we are describing is to examine an audio CD, which can store 650MB (megabytes) of un-encoded video. That memory is sufficient for a little more than five minutes of video. When however, the video signal is appropriately encoded/compressed the CD can store up to 74 minutes of video. Even with the increased storage capacity of the current generation of DVD, there is still an obvious need for the MPEG2 encoding to achieve adequate programme length.

One of most critical benefits of MPEG2 is visible to you already, on satellite and other broadcasts which you now see on a daily basis on your TV sets. MPEG2 encoding is being used to enable satellites, and conventional and optical cables to transmit multiple video/audio signals with a bandwidth requirement that is a small fraction of what would otherwise be required. Where bandwidth is at a premium, this is of critical importance, as all that is required is an encoder at one end, and a decoder at the other.

I discovered at Eindhoven that the MPEG2 encoding capability makes it feasible to store an encoded video/audio signal using a conventional desktop computer, with additional memory banks to match the total data storage requirement.

MPEG1 and MPEG2

In preparing an MPEG2 signal, the information contained in the original signal is analysed to determine what elements in successive frames, or samples of the sound are redundant (i.e. simply repeating what will have already been sent). Redundant information is discarded without affecting the quality of either the audio or video signal. The processes involved in the audio and video encoding process, are however very different as a result of the inherent differences in the structure of the source information.

There are radical differences between MPEG1 and MPEG2. MPEG1 is designed for either mono or stereo audio, with bit rates of between 32 and 384kb/s (kilobits per second). MPEG2 is backward compatible to MPEG1 and will accept its audio signals. Thus an MPEG2 decoder can decode an MPEG1 audio signal to extract its stereo signal.

An MPEG1 encoded video signal has a number of limitations. The most significant is its inability to support an interlaced video signal. MPEG2 supports fully interlaced video, and delivers studio quality pictures at bit rates which may range from 4 - 9Mb/s (megabits/sec).

The video encoding standard of MPEG2 is already being used in America, Japan and other countries which use NTSC based video systems for the video encoding of DVD discs. However those countries have adopted the Dolby Digital audio standard in preference to the MPEG2 audio standard, which is optionally available, where required.

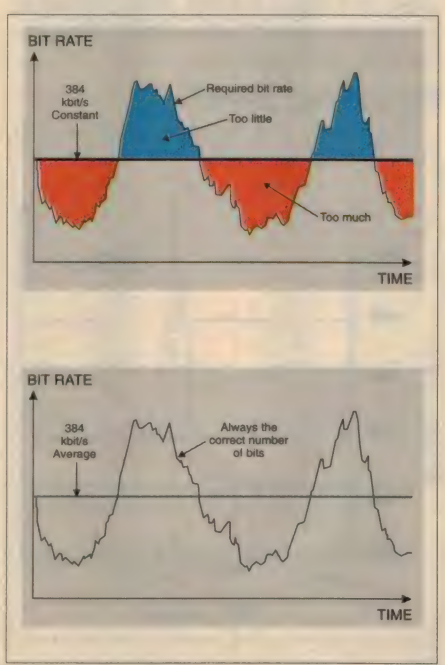


Fig.1: A comparison of fixed and variable bit rate encoding. A constant bit rate system can 'coast' during undemanding programme material, but be unable to cope in demanding sections.

A key part of the MPEG2 authoring system is this mobile rack, with a pair of digital video recorders and a Philips DVS 3110 Video Encoder (bottom panel). An adjacent 200MHz Pentium computer is augmented by 6GB of external memory.

As I discovered, the composite MPEG2 audio/video standard has been adopted by all countries in which the existing TV standards are either PAL or SECAM. That of course includes Australia and New Zealand, with PAL based systems.

MPEG2 audio is extremely flexible. It can operate at a wide range of bit rates, which may be as low as 8kb/s and up to more than 1Mb/sec. It supports sampling rates of 16, 22.05, 24, 32, 44.1 and 48kS/s (kilosamples per second). For stereo the most typical applications would operate at average bit rates lying between 128-246kb/s. By contrast, a multi-channel movie sound track requires an average bit rate of 320 to 640kb/s, depending on the number of channels and of course the complexity of the audio signal being decoded.

MPEG2 defines an extension for five full bandwidth audio channels plus a low frequency enhancement channel, and is thus comparable with — although not compatible with — Dolby Digital.

Unlike the Dolby Digital system the MPEG2 system also defines two additional channels, making a total of 7.1 where encoded, or as required. The five normal channels are left, right, centre low frequency enhancement, and left and right rear (or surround).

About MPEG audio

How does MPEG audio work? Over the last 30 years there has been extensive research in the field of acoustics, and specif-

ically into the non-linear and adaptive threshold characteristics of the human ear. The threshold of hearing is the level below which a sound is no longer detected in the presence of other sounds. There is no absolute level, as the threshold level is a function of an individual's sensitivity, as well as being dependent on the specific frequency of the sound.

As you may be aware, most people's hearing is more sensitive in the region 2 - 5kHz. But our threshold of hearing is highly adaptive, and is constantly changing in the presence of the sounds that we hear. Thus, by way of example, when a bus goes by or an aeroplane passes over the roof of our house, the sound that we might otherwise have readily detected is rendered inaudible by what is termed 'the masking effect' of the higher intensity sound.

This adaptive characteristic of our hearing has similar significance when listening to music. When one instrument in an orchestra or band plays louder than the other instruments, some of the sound produced by those other instruments is effectively masked, and thus rendered inaudible. Whilst all of that energy may be recorded on a disc or a CD recording, our ears are incapable of detecting it, even though it may be readily identified by a Fourier analysis.

Whilst a conventional CD recording using linear techniques may be regarded as being the optimum or preferred method of recording such sound, an encoded or compressed signal will convey almost identical sound to your ears, but with only a fraction of the bandwidth and data storage capability being required.

The two best examples of where this has already been used are in Philips' Digital Compact Cassette (DCC) and the Sony Minidisc (its MD format). Both DCC and MD formats use a fixed bit-rate encoding system. Whilst reasonably effective and aurally satisfying, neither of those systems offers the level of compression which the MPEG committee believed DVD sound needed to achieve in order to fulfil its ultimate goals.

When assessing any audio programme, and particularly music, some segments are far more acoustically complex than others. A good example of this is when the whole orchestra is playing as compared with a soloist, or single instrument. As a result, the number of bits of information required at any specific time to faithfully encode and subsequently reproduce that content vary with time.

If we wish to encode the signal in the most practical and economical way, it would be advantageous for us to be able to 'save' bits during the simple sections and make use of those bits to encode the more complex ones. That is the basis of a *variable bit-rate* encoding system.

If we imagine that we have a movie soundtrack containing a wide variety of complex sounds which may include speech, music, sound effects or even silence, the variations between their energy density and time of occurrence will fluctuate as the soundtrack progresses. In a typical movie soundtrack for a vast bulk of the time, a bit rate of approximately 384kb/s will prove to be adequate to encode the full 5.1 channels of sound with sufficient fidelity and 'transparency', so that you would be unable to detect any difference between the encoded sound when compared with the original. However some sections of that same soundtrack are clearly more demanding, and to maintain the transparency of the signal may warrant a 600kb/s bit-rate, where the complexity of the soundtrack simultaneously involves sound, music, sound effects, voice-over and background noise.

MPEG2 provides the ability to cater for that short-term demand by adopting a variable bit rate, thereby facilitating the transparency of the most demanding sections of sound at a higher bit-rate, and reverting to a lower bit-rate for the less demanding sections of the soundtrack.

PICTURE TYPE	BIT ALLOCATION
INTRA	400KBIT
PREDICTIVE	200KBIT
BI-DIRECTIONAL	80KBIT

Table 1: Typical bit allocations for the three different types of picture frame in an NTSC-based MPEG2 video signal (30fps CCIR 601 format, 4Mb/s).

How about video?

One of my first requests on arriving at Eindhoven was to learn how MPEG2 dealt with the complex problems of video encoding, and what sort of equipment would be used to achieve the complex encoding procedure.

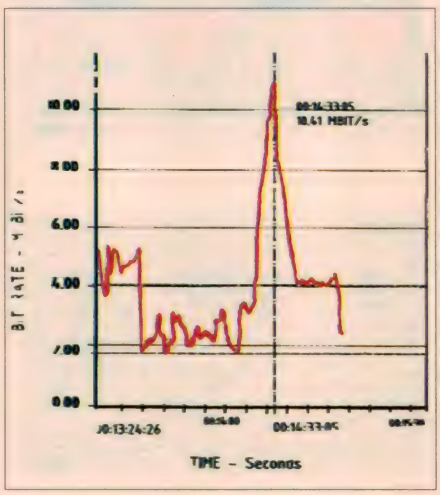


Fig.2: A graph showing the actual bit rate (in megabits/second) for MPEG2 encoding of a typical video signal. Although the average is around 4Mb/s, a 'demanding' section can require more than 10Mb/s.

Philips' Eindhoven facility is unbelievably large, with literally dozens of multi-storey buildings, covering vast areas of land in the centre of the city. We were escorted by Rinske Stege, Philips' competent press officer, who shepherded us to the Business Line DVD building. There, on one of the upper floors of the building, we met senior product manager Eric Tijssen and his support team.

We were introduced to a Philips' mastering and duplication system, in which two digital recorders were mounted in a mobile rack with a Philips DVS 3110 Video Encoder. On an adjacent desk a 200MHz Pentium computer was mounted with two Philips professional monitors, and the ubiquitous computer keyboard and mouse. The computer was supplemented by a stack of three external memory modules providing 6GB (gigabytes) of external memory.

We were able to monitor the computer's screen to view displays using a Windows 95 format, in which various critical parameters were being monitored. The two most critical displays were those on which the variable bit-rate requirements of the video signal and the audio signal were presented.

I soon learnt that MPEG2 is now an ISO/IEC Standard that specifies what they describe as being the 'syntax and semantics of an encoded video bitstream'. The parameters defined include the bit rates, picture size and the resolution quality that may be applied, as well as how the picture will be decoded to reconstruct the picture.

MPEG2 does not however define how a decoder or an encoder should be implemented, only that they should comply with the MPEG2 standard. This of course leaves the option open for development of superior encoding and decoding methods, as well as the hardware that goes with it.

The system that Philips demonstrated was a fully developed, tested and working product that is already being sold in significant numbers in Europe and Australasia. As I write, the first Philips MPEG2 authoring system is being installed in Sydney, and we will tell you more about that later.

The MPEG2 system which Philips demonstrated has a resolution capability of 720 x

576 pixels, with an interlaced video display based on a standard 25fps (frames per second) update rate.

The video information is encoded using two main techniques. These are respectively described as being 'spatial' and 'temporal' compression. 'Spatial' compression involves an analysis of each picture to determine how much redundant information is contained within that picture. Any frequencies, and their related components that would not be visible to the human eye are then discarded. 'Temporal' compression involves encoding the differences between successive pictures.

If we imagine a scene in which there is no movement whatsoever, and subsequently an object moves across the picture, the first picture in the sequence will contain all the information required until there is movement. There is no need to encode any additional information until the movement starts to occur. Thereafter, all that needs to be encoded is the part of the picture in which the movement is visible. The rest of the scene is not affected by the movement of that object, because it is the same as the data contained in the first picture.

The mechanism by which we relate the movement and the changes between two successive pictures is defined as being *motion estimation prediction*. The information extracted from this predictive process is used by the 'motion compensation prediction' to define which portion of the picture may be discarded.

The inter-relationship of these parameters means that any single frame of a picture cannot be considered in isolation. Any given picture is constructed on the basis of a prediction which makes use of the previous picture (frame). That frame will be similarly used to provide the basis for the next picture's frame.

The MPEG2 standard defines three different types of pictures. Firstly we have the I or Intra-frame picture, which is encoded without reference to any other picture, and which affords random access of data. Next we have the P or Predictive picture, which is encoded using a motion compensated prediction based on the previous picture. The P picture thus contains reference material derived directly from the previous picture frame. Each P picture will itself be used as a basis for subsequent predictions.

Last but not least, we have the B or Bi-directional pictures, which are encoded using motion compensated prediction based on both the previous and the next picture in the sequence, which must also be either a B or a P picture. B pictures are not however used in subsequent predictions. I, P and B pictures are formed into a composite group of pictures (GOP).

Each picture type I, P and B provides increased opportunity for data redundancy. An I picture is encoded with relatively little data compression, with the compression being limited to the spatially redundant information. By contrast, the P and B pictures also use motion compensation to remove temporarily redundant information.

Part of the setup in Philips' MPEG2 authoring system, showing the 'before and after' video monitors and the computer monitor displaying the key encoding parameters.

B pictures generally incorporate the highest degree of compression. Typical bit allocations for an NTSC based signal (30Hz CCIR 601 format at 4Mb/s) are shown in Table 1.

Spatial compression is achieved in practice by use of a DCT (Discrete Cosine Transform) algorithm. This converts the information in the picture to be encoded into the frequency domain. The DCT transform is used to remove redundant information within the picture itself. By removing those frequency components which display negligible amplitude, and rounding the frequency co-efficients to standard values (particularly at higher frequencies), the contrast is less perceptible to the human eye, and can thus be deleted.

Further compression can also be achieved by using a process called 'run length encoding'. During this operation any regular or repetitive patterns in the frequency information derived during the DCT are detected, and replaced by a shorter representative pattern, providing even higher compression efficiency.

Motion compensated prediction is used to exploit redundant *temporal* information, that is not changing from picture to picture. The images in a video stream do not generally change very much during short time intervals. The underlying principle in motion compensated prediction is to encode each video frame based on the other video frames which are close to it in time.

Motion estimation prediction determines the amount of differential movement between two successive picture frames. This is achieved by dividing the picture into macroblocks. Each macroblock is a square of 16 x 16 pixels, which are each examined for the closest match in the search area of the picture, in either a B or P picture. When a match is found, the offset (or motion vector) between the two pictures is calculated.

The matching parts are then used to generate a predictive picture, by use of those motion vectors. The prediction picture is then compared in the same manner to the picture to be encoded. Macroblocks which have a match have already been encoded, and are thus redundant. Macroblocks which have no match to any part of the search area in the picture to be encoded, represent the differences between the pictures, and these are encoded.

Samples demonstrated

Whilst these complex concepts were being explained to us, we were shown a Philips MPEG2 authoring suite of the type that is currently being commissioned in Sydney. Various examples of different types of signals were then played through the authoring system using a studio video recorder whose output was displayed on one screen, whilst the MPEG2 encoded video output signal was shown on an adjacent screen.

The MPEG2 encoding process, with its variable bit-rate, copes quite happily with most signals but not with all. The example that was displayed to us as being typical of the most 'unacceptable' and 'complex' signal would not have been the subject matter that I would have picked as being the most difficult for the system. The scene that was displayed incorporated a close-up of leaves on a tree subject to wind motion. As you will appreciate, the vast proportion of macroblocks on the screen were subject to gross motion, with the motion vectors being dissimilar and generally random between different sections of each frame. The predictive procedure in such circumstances cannot cope with the complexity of the task, and as you will note on the attached graph, the information rate can double, or even triple the normal expected variable bit-rate capabilities of the system.

We learned that the I-format frames are then used to transfer information both backwards in time, and somewhat to our surprise, forwards in time, in order to spread the complex data required in a given frame into frames where the information or bit-density is less than the system's upper limit.

(Continued on page25)

OLYMPUS CAMEDIA C-800L DIGITAL CAMERA

Digital still camera technology continues to surge forward, with each new model offering either higher performance or lower cost — or both. One of the most impressive of the latest entries is the C-800L from renowned Japanese camera maker Olympus, offering excellent performance in a very compact and convenient package. EA's editor recently took one on a trip, and reports here on what he found...

by JIM ROWE

When the first consumer-level digital still cameras (DSCs) appeared a couple of years ago, they were pretty modest — not just in terms of their basic image-capturing performance, but also with respect to providing the features that many of us had come to expect in traditional film-based cameras. Frankly, with some of those first few models it seemed very much as if we were going right back to the 'box brownie' days of fixed focus lenses, direct viewfinders with parallax error and very little control — plus, of course, fairly poor image resolution and the ability to store a relatively small number of images before they had to be downloaded into your PC. About the only real appeal of these first few models was that they represented what could be done using the latest technology...

But quite clearly things have progressed quite rapidly since then, and not just in terms of sheer image resolution, although this has certainly been pushing forward. Now just about all of the current models provide at least 640 x 480 pixel resolution, which is sufficient for a lot of everyday needs — and fine for the increasingly popular practice of sending electronic 'snaps' via email. A significant number of models now offer 756 x 504 pixel resolution, while a few models (like the Olympus C-800L reviewed here) go even further, and provide a very impressive 1024 x 768 pixels or full 'SVGA' resolution.

Happily along with these increases in resolution has come a corresponding improvement in the performance and flexibility of DSCs as practical cameras. For example the lenses are now often autofocussing as well as auto exposure, and along with the direct viewfinder there's frequently a small LCD viewfinder/review screen, to return some of the benefits of a traditional SLR (single lens reflex) viewfinder system.

The new Olympus C-800L camera is a particularly impressive example of this 'new breed' of DSC, and that's why I jumped at the opportunity to review one. Especially as I had a short overseas trip coming up, and the Olympus distributor R. Gunz (Photographic) didn't seem to mind my taking it with me, to give it a good workout.

I must confess that it was the 1024 x 768 pixel resolution that drew my attention to the C-800L in the first place; I knew that with this kind of resolution, it would have a lot more potential for day-to-day magazine work. But Olympus is of course a long-time maker of highly-regarded traditional film cameras, and also famous for the quality of its lenses. All of which suggested that although the C-800L might look fairly unassuming, on closer examination it could turn out to be a very interesting and practical little beast. And so it turned out to be...

By the way I should perhaps mention at this point that the C-800L is currently the 'flagship' of Olympus' range of DSCs. In Australia they also sell the C-400L, which looks almost identical but offers a maximum image resolution of only 640 x 480 pixels. Apart from that it's very similar, and shares the same excellent lens; the main other differences are that the C-400L is fixed focus and has a smaller

One of the pictures taken by the author on his trip, using the Olympus C-800L. It shows the historic Round Barn, in Santa Rosa, Northern California.

The C-800L shown slightly larger than actual size. the sliding lens cover also acts as a power switch, in 'taking' mode. On the rear is a 45mm-diagonal colour monitor panel, for checking exact shot composition and also reviewing the images in memory.

internal memory, storing only 20 of its high quality images. It's also considerably cheaper.

Both cameras are very similar in overall size and shape to a traditional 'compact' 35mm camera, and have a small built-in electronic flash. This is located at top centre of the front, while the taking lens and viewfinder are to the left of centre — the first hint that the cameras use electronic capture rather than film. The taking lens has a sliding cover 'door' which doubles as an on-off switch for the camera in 'taking' mode.

The main lens is a high quality all-glass job, with five elements in four groups. It has a focal length of 5mm and a maximum aperture of f/2.8, and when coupled to the 8.5mm CCD image sensors used in the cameras it offers a field of view equivalent to a 36mm lens on a traditional 35mm camera. In other words, a reasonably 'wide angle' view.

The optical resolution of this lens is reputedly around 106 lines/mm, which I gather is roughly double that of the lens in a typical 35mm compact film camera. Amazing from such a tiny lens system, with a working aperture of less than 2mm!

In both cameras the lens is coupled to a TTL auto exposure system using a 'centre weighted average' metering technique which Olympus has apparently used very successfully in its film cameras. In the C-800L the lens appears to have three working apertures (f/2.8, 5.6 and 11), with shutter speeds used for the fine control. The mechanical shutter speeds range from 1/8th to 1/500th second.

By the way the sensitivity of the sensor in the C-800L camera is equivalent to ISO 100 (i.e., about the same as 100 ASA film). The sensor is of the interlaced-scan type, presumably because progressive-scan CCDs aren't as yet capable of delivering 1024 x 768 pixel resolution.

The C-800L also provides autofocussing (AF), again via a TTL system. It's apparently of the type which maximises contrast changes, and seems to work equally well at near and far distances. The C-800L has two focus ranges, the 'normal' range covering nominally from 700mm to infinity and the 'macro' range from 700mm down to a nominal 200mm (but with reasonable light levels seems to be nearer 150mm).

The AF system focusses on the object in the centre of view, but Olympus has given it a very handy lock function to allow creative flexibility. You can press the release button halfway down to focus and lock the AF

Olympus C-800L Camera

An advanced digital still camera taking images at 1024 x 768 pixels in HQ mode or 512 x 384 pixels in Standard mode. 6MB of internal flash memory stores up to 30 HQ images or 120 standard images. Auto focus, TTL auto exposure. Five element glass lens, 5mm F/2.8 (equivalent to 36mm lens on a 35mm camera). Optical real-image viewfinder plus 45mm TFT colour LCD monitor.

Good points: Excellent lens, provides very sharp images. Macro mode focusses down to 200mm. Flexible, but still easy to use — both when taking images and loading them into a PC. Uses standard AA alkaline cells (four). Good image storage capacity.

Bad points: Nothing serious. If it had a zoom lens for easier closeups, an SLR-type viewfinder and perhaps could take extra plug-in cards for even more memory, our wish list would be totally fulfilled.

RRP: $1699 including sales tax. A mating low cost dye-sublimation colour printer is coming, for less than $1000.

Available: From digital camera specialists. For your nearest dealer contact distributor R. Gunz (Photographic), 2/26-34 Dunning Avenue, Rosebery 2018; phone (02) 9935 6600 or fax (02) 9935 6622.

system on the desired subject, and then pan/tilt the camera to get your desired composition, before pressing the release further down to take the shot. It's both simple and convenient.

Although the direct viewfinder in the C-800L has a small amount of parallel error (about 5mm horizontally, and 15mm vertically), it's augmented by a nice little colour LCD screen on the rear of the camera to let you both confirm exact composition and later review your shots. The LCD is of the TFT (thin-film transistor) type, for reasonably high speed response, and has a diagonal measurement of 45mm. Needless to say its resolution (about 61,000 pixels) doesn't match that of the CCD capturing the images, but overall it's sufficient for the job.

Another nice feature of both the C-800L and C-400L is the way the internal flash has four selectable operating modes: auto (the default), red-eye reduction (i.e., multiple brief pre-flashes), off and fill-in. These are likely to cope with most situations in practice.

With an image resolution of 1024 x 768 or 810,000 pixels per image, you might expect the C-800L to be capable of storing only a few of these images in its internal memory. But you'd be wrong, because it can store an impressive 30 of these images, or 120 of the 512 x 384 pixel 'standard res' images. How's it done? Partly by giving it a husky 6MB (yes, six megabytes) of built-in flash RAM, and partly by saving the images straight away in high quality JPEG compressed image format.

Needless to say that's also the format in which the images are downloaded into your PC (IBM compatible or Mac), using the utility software that comes with the C-800L on CD-ROM. More about this shortly.

Controlling the camera is easy and convenient. There's a small LCD readout on the top of the case, indicating things like battery status, shots left in memory at the current image resolution, AF and flash modes, and so on. Along with the main release button there are also five small pushbuttons, three of which allow you to select image resolution, standard/macro mode and flash mode. Another button lets you activate a 12-second electronic delay timer, while the fifth is used for selective image erasure. More on this in a moment.

On the rear of the camera, to the right of the LCD screen, there are three further small buttons. A small green one activates the LCD, for either use as a viewfinder in 'taking' mode, or viewing/reviewing the shots in memory. The other two buttons allow you to step forward or back through the memory, when you're reviewing or editing the stored images.

Note that I wrote 'editing', because that's exactly what you can do — well, you can selectively cull out the images that weren't what you wanted, at least. As well as wiping the lot, if you wish, after downloading them into your PC.

Here's where that selective erase button comes in, allowing you to erase any desired image when it's visible on the LCD. The microcomputer in the C-800L even makes you confirm that erasing is what you want, to prevent accidents; you have to follow up by pressing the release button in response to its 'Yes/No?' query, or the image is kept.

There's also the ability to 'lock' any particular image(s) you especially don't want to lose, so they can't even be manually erased without unlocking again. Just to make sure!

What this selective erase facility means, of course, is that when you're away from the PC you can still take and store up to 30 'good' high-res shots (or 120 standard-res shots, or a mixture of the two), before being unable to take any more because of having a 'full' memory. It's much better than with the first-generation DSCs, and even better than having a 30-shot roll of film — because here you can check the shots as you go, and discard the duds to leave room for more...

By the way the C-800L also contains a built-in clock/calendar, which automatically 'time and date stamps' your images. It runs on four AA-size alkaline cells, plus a 3V lithium cell for memory backup. There's also a DC input socket for use with an optional plug pack mains power supply.

The camera itself has an RS-232C serial interface for connecting to the computer, and can run at up to 57.6kb/s for speedy downloads. The serial port uses a miniature 8-pin DIN socket, and matching cables are supplied to suit both PCs and Macs.

On the software side, the C-800L doesn't come bundled with any image editing packages, of either the full-strength or 'lite' variety as often supplied with other DSCs. However the utilities that come with it on the accompanying CD-ROM provide all of the basic facilities for downloading 'thumbnail' images from the camera, downloading any or all of the desired images,

Another picture taken using the Olympus C-800L, in this case showing Bill Van Eron, PR manager for the Colorado EMD divisions of Hewlett-Packard, at the 'Garden of the Gods' park in Colorado Springs.

viewing and saving them to disk, rotating them by 90 degrees and also controlling camera functions. You can also set the camera's clock and calendar, remotely erase images in its memory, check battry status and so on. Presumably Olympus believes that most 'serious' users who want to do more elaborate image manipulation will already have access to the appropriate packages, like Photoshop, Picture Publisher etc. Which seems likely.

Using it in practice

After trying the review C-800L the weekend before I went away, to get familiar with using it, I was so impressed with both its performance and ease of use that I elected to leave my trusty 35mm SLR film camera at home, and take only the Olympus. A little foolhardy, perhaps, but the C-800L had already struck me as eminently practical and reliable...

And so it turned out to be. During the trip I had the opportunity to take a wide variety of shots, at various distances and in a variety of light conditions. Each time the C-800L performed flawlessly, and any shortcomings in the quality of shots taken were basically attributable to the operator (me). Generally it gave results which were every bit as good as you'd expect from a 35mm compact, and often comparable with what I'd expect from my SLR.

As with all CCD-based DSCs (and camcorders) as yet, there's a tiny bit of fringing on the edges of objects in fairly contrasty images, but in this case it's generally almost imperceptible.

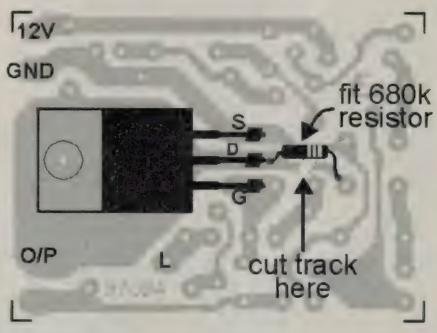
All in all, then, I'm *very* impressed with the Olympus Camedia C-800L. It takes very high quality, high res images, and it's just as well equipped and easy to use as a conventional film-based camera. It also has enough memory to store a practical number of images, without the need for expensive add-in memory cards or disk drives.

So although the C-800L certainly isn't the cheapest DSC around, at the quoted RRP of $1699, by the same token it undoubtedly delivers a great deal in terms of both convenience and performance. Of the DSCs I've tried out to date, it's the only one that has made me want to buy one.

By the way, Olympus is about to release a matching dye-sublimation colour printer to go with the C-800L, the P-150E. I've seen samples of its 109 x 82mm x 148dpi prints, and they look good. Hopefully we'll be able to review one of these soon, as well. ❖

NOTES&ERRATA

Interior Light Delay for Cars (April 1997): The 'B' version of the circuit may false trigger if there are significant fluctuations on a vehicle's +12V supply. To make the circuit less sensitive, first change R8 from 150k to 47k. If there is still a problem, then add a 680k resistor in series with C1 (on the copper side of the PCB), as shown in the associated diagram.



Add-on Regulator for 12V Battery Charger (July 1997): The designators for R8 and R9 are reversed on the component overlay diagram on page 58. The upper (large) 5W resistor is in fact R8, while the smaller resistor just below C6 is R9. The schematic and parts list are correct.

Remote Power-up (June 1997):
There is a small error in the Remote Power-up's IC numbering. The designators IC2 and IC3 should be swapped on the component overlay diagram (page 55) and in the parts list (page 61) - as shown in the schematic, IC2 is in fact a 4017 and IC3 is a 4020.
Note that in this does not really effect the unit's construction since the IC *type* labeling is correct on the overlay diagram, and the 4017 and 4020 ICs go in the positions as shown. ❖

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WOMEN AND THE CHALLENGE OF SPACE FLIGHT

As in many other areas of human activity, space exploration was for a long time regarded as an exclusively male domain. There's no doubt that women have now proven their capabilities as shuttle pilots and space mission specialists, but it has been quite a struggle to get this far. Here's how entrenched attitudes were changed...

by KATE DOOLAN and COLIN BURGESS

On 3rd December 1996, veteran US astronaut Dr Shannon Lucid was smiling proudly as President Bill Clinton conferred on her the first Congressional Space Medal of Honor to be awarded to a woman. At the same ceremony, President Clinton praised Lucid as a 'determined visionary'. Lucid had recently returned from her fifth spaceflight, during which she spent more than six months orbiting the Earth with two Russians in cramped, uncomfortable conditions aboard the space station Mir.

"Most pioneers set their sights on just one frontier", Clinton said. "Shannon Lucid has pushed to the furthermost reaches of two: the frontiers of both space and science. She has done so with brainpower, willpower, courage, skill and good humour."

Shannon Lucid would have needed her humour earlier in the year when, prior to her record breaking 188-day mission, General Yuri Glazkov, a former cosmonaut and current deputy commander of the Yuri Gagarin Cosmonaut Training Centre in Russia, stated at a press conference that Lucid's presence aboard Mir would brighten the space station and force her all male colleagues to be on their best behaviour. Unfortunately, demeaning her future tasks and accomplishments, Glazkov joked that the orbiting crew was looking forward to her stay "because being a woman, she will keep the place clean. We know that women love to clean."

It was an unmindful trivialisation of what would prove to be an outstanding science mission conducted by the dedicated 53-year-old American. But for Lucid and other women astronaut aspi-

rants, such condescension was nothing new or unusual.

These days it is not unusual for female space explorers to fly into orbit on a regular basis. Although Shannon Lucid's mission to Mir was deemed newsworthy by the world media, usually they pay scant attention to the feats of these remarkable women. However, this has not always been the case.

In the first 25 years of the Space Age, 1957 to 1982, only two of the 106 space travellers were women. Both of these women were Soviet cosmonauts, who were sent into orbit for very obvious and dubious propaganda purposes.

The first woman to fly into space was 26-year-old Valentina Tereshkova, in June 1963. Incredibly, the year before her flight she was just a factory worker who had a passion for making parachute jumps at the local airfield. In the three decades since her flight, there have been persistent rumours, strongly denied by the lady herself, that she became ill and was disoriented during her flight.

Despite Soviet propaganda to the contrary, Tereshkova and her four female back-up pilots had not found easy acceptance by their male colleagues during training. The men were all highly-skilled pilots from the Red Air Force, whereas only one of the women had ever flown on an aircraft. The male cosmonauts scoffed at the women's presumptions of becoming their equal, whilst at the same time expressing concern that a valuable pilot's seat in the Vostok spacecraft would be 'handed over to an inexperienced woman'.

Valentina Tereshkova created history by becoming the first woman in space, but her flight on Vostok 6 would prove to be her one and only space mission. Soon after her historical flight, Tereshkova married fellow cosmonaut Andrian Nikolayev in a lavish and widely broadcast marriage ceremony in Moscow — a wedding said to be have been requested by Soviet Premier Nikita Krushchev. The marriage did not last, although they did produce a daughter named Yelena.

Like his male cosmonaut colleagues, Nikolayev felt that men would pioneer space flight whilst women would enjoy a subsidiary role to them. "We love our women very much", he declared, "we spare them as much as possible. In the future, however, they will surely work aboard space stations as specialists: doctors, geologists, astronomers and of course as stewardesses!"

It was recently revealed that the Soviet Union had plans to launch an all-woman crew of two into space aboard Voskhod 4, the next generation of Soviet spacecraft in 1966. Unfortunately for the women, the erudite Chief Designer of the Soviet space program, Sergei Korolev, died in January 1966 and all planned Voskhod missions were cancelled. With no chance of flying into space, the four women left the cosmonaut detachment in October 1969.

Despite the massive propaganda coup created by Tereshkova's 1963 flight, it would be another 19 years before another Soviet woman was sent into space. This time it was Svetlana Savitskaya, a test pilot and former world aerobatic champion, who would eventually make two space flights: one in August 1982 and the second in July 1984.

On 19 April 1982 it was publicly announced that astronaut Dr Sally Ride was assigned to STS 7, which would make her the first American woman to fly in space during June 1983. The Soviets, it seemed were still in the spoiling game as they sent Savitskaya into orbit on Soyuz T-7, stealing some of Ride's thunder.

There was more spoiling to be done. In 1984, it was announced that astronaut Dr Kathy Sullivan would make the world's first spacewalk by a woman in October. The Soviet response to this was to schedule a special flight so Savitskaya could make a brief spacewalk carrying out some exterior welding tasks in July — barely three months before Sullivan.

The 'Astronettes'

In 1958 it was suggested to the National Aeronautics and Space Administration (NASA) that they fly women in space, but this was ignored. The first group of astronauts to be selected in 1959 were all military test pilots, then a male-only domain.

In 1960 renowned aviator Jacqueline Cochran, who had been the first woman to exceed the speed of sound in 1953, teamed up with Dr Randolph Lovelace at his clinic in Alberquerque in New Mexico, specifically to test women for astronaut abilities.

At this time, Cochran was also appointed a consultant to NASA administrator James Webb. 20 women pilots applied and 12 including Geraldyn (Jerrie) Cobb undertook testing at the Lovelace Clinic, with Cochran personally covering all travelling and maintenance costs. The candidates then moved onto further rigorous testing at a Naval medical laboratory in Pensacola, Florida. Despite the successful completion of the program by Cobb and her colleagues, Webb ordered the abandonment of the test project.

When it was publicly announced that NASA had been testing women with a view to accepting them as astronauts, the media acted with predicted chauvinism — dubbing the trainees 'spacegals', 'astrodolls' and 'astronettes'. Whilst this media circus was taking place, Jerrie Cobb and another of the trainees Jane Hart (who was married to Senator Phillip Hart) travelled to Washington DC where they lobbied Vice President Lyndon Johnson. Under pressure,

Dr Shannon Lucid pictured 'working out' on a treadmill device aboard Russia's Mir Space Station, during her long stay in orbit last year. On the opposite page, mission specialist Dr Mae Jemison checks equipment in Endeavour's science module, during the 1992 Spacelab-J mission.

Johnson ordered Congress to review the situation.

In July 1962, Cobb and Hart testified publicly before the House of Representatives' Space Subcommittee, accusing NASA of unreasonable discrimination. One of the basic astronaut requirements, they argued, was that any applicant was to have a science degree and two of the Mercury 7 astronauts, Scott Carpenter and John Glenn did not.

In response, Glenn defended NASA's policies, claiming at the hearing that if there were qualified women, NASA would accept them into the astronaut program. Glenn also queried the women's lack of flight training and questioned whether they should be subjected to the space environment. It is interesting to note at that time that Jerrie Cobb had accumulated over 10,000 hours flying time, which was double that of Glenn and five times that of Carpenter.

Another Mercury astronaut, Gordon Cooper, was a little more pungent and chauvinistic when asked for his feelings on the subject. "All this talk about brains and dames in space is bunk. As for the ladies to date, there have been no women — and I say absolutely zero women who are qualified to take part in our space program."

Also testifying at the hearings was aviator Jackie Cochran. She had also undergone the testing, but that knew the age limits for astronauts would automatically prohibit her from applying.

Cochran, who had initiated and funded the entire women's test program, actually did no favours for women aspiring to become astronauts or military pilots, by claiming that both NASA and the military would lose money if they trained women — who would never finish the program because "marriage is the basic objective of all women".

Cochran suggested that Congress proceed slowly, saying that there was insufficient evidence to compare men and women physically and psychologically. The end result was that Congress refused to consider a mixed space program.

The women were embittered by Jackie Cochran's apparent betrayal. "I don't know if she hurt our cause or not", declared participant Gene Nora Jessen. "Some think that it was a dirty thing to do and others say, well, maybe she was being sincere. I got the impression... that it was a pretty much foregone conclusion that Mercury astronauts had thrown their weight around and seen to it that there were no women in the space program."

Mission specialist Rhea Seddon pretends to lift fellow astronaut Robert Gibson above her head, during a zero-gravity training exercise on board a KC-135 aircraft, in 1979. The two were married in 1981.

Valentina Tereshkova's space flight only served to increase hostilities between NASA and women's groups. Senator Ernest Gruening, a strong supporter of women astronauts, publicly chastised the space agency. NASA, always keen to present an image of innovation and forward thinking, derived some of its worst publicity at that time over its no-women-in-space policy.

One of those who wrote to NASA at this time requesting details on how to become an astronaut was a feisty high school student from Chicago named Hillary Rodham. Miss Rodham received a letter back telling her that 'girls need not apply'. Hillary Rodham would later marry a lawyer named Bill Clinton and is today, America's First Lady.

Jerrie Cobb, eager to keep a foot in the door, took on a job as a special consultant to NASA Administrator Jim Webb; to but to no avail. Much to her chagrin, she was never called upon for advice.

Changing times

During the following 15 years and under some pressure, NASA began employing more women in professional roles such as engineers, scientists, doctors and geologists.

In 1973, a group of 12 air force nurses volunteered for five weeks of tests to observe their reactions to high gravity loads. The eventual finding of these tests was that women were suited to the demands of space flight.

A year earlier, with the advent of the space shuttle program, NASA Administrator James Fletcher had announced that there would be opportunities for women and minorities to become astronauts. By this time many groups, including Congress and the media, had paid significant attention to the fact that the Astronaut Office was an all-white and all-male enclave.

With the successful lunar program now at an end and savage budget cuts tearing away at its once unassailable budget, NASA had to pay heed. The space agency was becoming dependent on public support, not only for its future programs but for its very survival. Consequently NASA stated that the next astronaut intake, scheduled for the late 1970s, would include women and minorities.

In July 1976, NASA announced that it was recruiting astronauts to fly on the space shuttle. There were to be two categories to fly on the shuttle: pilots who would fly the vehicle, and mission specialists who would be responsible for

Astronaut Sally Ride preparing to service the monodisperse latex reactor experiment on board the Challenger shuttle, during mission STS-7 in 1983

conducting experiments, deploying satellites and undergoing extra vehicular activity ('spacewalks').

An extensive and well-publicised recruiting campaign was undertaken in search of suitable candidates, with advertisements featured in women's magazines, university publications and technical journals. Curiously enough, the enquiry rate was low, so NASA took the unusual step of hiring *Star Trek* actor Nichelle (Lieutenant Uhura) Nichols to produce and star in a series of commercials, as well as undertaking public speaking tours. Nichols performed her tasks well, extolling the opportunities available to women and minorities should they be selected as astronauts, and the application rate soared as a consequence.

During the year-long recruiting effort, a total of 8079 applications was received. 1251 women applied for Mission Specialist training. After initial screening by the staff of the Johnson Space Center in Houston, Texas, 208 people were selected for further medical tests and interviews — including 21 women. This time the physical requirements were far more realistic and each candidate was asked questions which quite deliberately had no inherent gender bias.

On 16 January 1978, NASA Administrator Robert Frosch announced the selection of 35 new astronaut candidates (ASCANS). The 15 pilots were all males, but in the Mission Specialist category there were 20 people including six women plus three black Americans and one Asian American.

In later years there would be persistent rumours that only one woman had originally been selected, and this was confirmed in 1994 by Donald ('Deke') Slayton — an original Mercury astronaut and one-time Chief Astronaut, responsible for crew selections. In his posthumously released biography, *Deke*, he wrote '...the original selection had 20 pilots and 15 mission specialists. Oops — only one woman made the cut, so five pilots were dropped from the list (they got selected a couple of years later) and replaced with five women mission specialists.'

All six women were qualified to place the title 'Doctor' in front of their names. They were Anna Fisher, MD; Shannon Lucid, with a PhD in Biochemistry; Judy Resnik, a PhD in Electrical Engineering; Sally Ride, a PhD in Physics; Rhea Seddon, MD and Kathy Sullivan, a PhD in Geology — who emphasised in her first press conference on the selection process that "astronauts don't have to be very feminine or very masculine women or superhuman males, or any colour or anything. It's about people in space."

Training begins

The training period for the new astronaut candidates commenced in August 1978 with survival techniques, but for the six women especially, the adulation and media hoop-la began to wear thin.

"My husband and I knew the attention would be intense for a while", said Anna Fisher, "but we never expected it to go on and on like this". During a survival test requiring trainees to plunge into the water after sliding down a wire from a 15-metre tower, an over exuberant photographer tried to catch Rhea Seddon's attention by yelling out "Hold it miss!" Seddon finally had enough: she fixed the offender with an icy stare and snapped "It's Doctor!"

Once survival training was completed, the ASCANs began classroom training which included lectures in spacecraft systems, geology, oceanography,

astronomy, biology and psychology. In August 1979, all 35 astronaut candidates were qualified for future space shuttle flights.

In the meantime, NASA sent the women and minority astronauts out on extensive public speaking tours. Although these tours were a success, the women felt that they were getting a rough deal from the Public Affairs Office — who pushed them repeatedly into the spotlight. Clearly, it was no bed of roses.

"To go from the total anonymity of being a researcher or graduate researcher to this has been quite a change, I can tell you", said Kathy Sullivan. "If I was on the outside, I'd be happy for the women in the program and at least mildly interested in how their careers are going. But the thing I find hard to swallow is the fascination with such inane things, like how many times I have played racquetball this week."

After the first orbital fight of the shuttle in April 1981, flight opportunities opened up and in March 1982 it was publicly announced that Sally Ride had been assigned to STS 7, which was scheduled for launch in May 1983.

With this announcement, Ride became one of the most celebrated women ever. Sally Ride appeared on the covers of every major American news magazine, and gracefully — but with growing inquietude — handled the now predictable questions from mainly male journalists. Examples: "Will you wear makeup in space?", "Will you wear a bra in space?" and "Will you cry when things go wrong?".

It must have been difficult for Dr Ride, a dedicated astrophysicist, to hold her tongue in the face of such puerility. Ride also raised the ire of some feminist activists when she said that she was far more excited about being selected for a flight rather than being the first American woman in space.

In response to all of the attention she had been receiving, Sally Ride remarked "It's too bad that this is such a big deal. It's too bad our society isn't further along. It's time that we get away from that and it's time that people realise that women in this country can do any job that they want to do."

Mission specialist Judith Resnick pictured about to don her face mask for a flight on a T-38 aircraft in May 1984, as a part of her training program. Dr Resnick died in the Challenger explosion of January 1986, with six other astronauts.

Lingering hassles

Even though a woman had been assigned to a space mission, there were still lingering problems relating to their gender. Anna Fisher, married to fellow astronaut Bill Fisher, became pregnant and was reluctant to inform NASA officials. She kept flying T-38 training jets until she was six months pregnant and owned up. Fortunately, they supported her and despite her fears, she was able to retain her astronaut status.

When Rhea Seddon married fellow astronaut Robert ('Hoot') Gibson, bride's magazines fell over each other trying to interview the groom!

Demonstrating one of the lighter predicaments when women became astronauts, the male technician in charge of packing personal belongings for Sally Ride's flight packed 100 tampons for her because he was too shy to ask her how many she would need for a six-day flight...

On 18 June 1983, Dr Ride was launched into space aboard the *Challenger*. Ever alert to the opportunities for gaining media attention, NASA invited thousands of women to the launch including feminist Gloria Steinem who had been (and still is) one of the main forces behind the

Major Eileen Collins (now Lieutenant-Colonel) pictured here with NASA instructor pilot Stephanie Wells at Ellington Air Force Base near Houston, after a training flight in 1990. Collins was shuttle pilot for the STS-84 mission this year.

women's movement.

Sally Ride's mother, Joyce, on witnessing the launch reportedly stated "Thank God for Gloria Steinem". The launch attracted thousands of spectators, many wearing T-shirts saying 'Ride, Sally, Ride!'

Along with her four male companions, Ride deployed two satellites — including a German free-flying satellite which obtained some magnificent images of *Challenger* in flight. During the flight, the crew received a phone call from President Ronald Reagan who told Sally Ride that "she was the best person for the job" and that is why she was aboard *Challenger*.

The next American woman in space was Judy Resnik on 41D in August 1984. On the first attempt to launch *Discovery* on 26 June 1984, one of the shuttle's main engines shut down, which forced the launch to abort with less than four seconds to liftoff. The flight was delayed to 30 August. Among the payload were three communications satellites, which were deployed during the mission without any problems. Resnik was responsible for deploying a 33-metre solar panel, an experiment in providing power for future space stations.

The following shuttle flight, STS 41G in October saw Sally Ride making her second flight into space along with Kathy Sullivan as part of a seven-person crew (including Australian born Paul Scully-Power), then a new record. On that flight, Sullivan became the first American woman to spacewalk along with Dave Leestma, successfully demonstrating techniques for toxic hydrazine refuelling of satellites.

During the next space shuttle flight STS 51A in November 1984, the crew successfully retrieved and returned to Earth two communications satellites that had failed earlier that year. Dr Anna Fisher, who was part of that crew was only the second woman in history to be awarded the Lloyd's of London Silver Medal for her part in the success of the retrieval. In a footnote to that flight, Anna Fisher also became the first mother to fly in space.

All six women from the first shuttle astronaut selection made at least one flight and in 1980, two more were selected — Dr Mary Cleave an environmental engineer, and Bonnie Dunbar, a ceramics engineer. Eventually more women were recruited as mission specialists and their selection finally ceased to be a novelty.

Tragedy strikes

The 1986 space shuttle manifest called for a record 15 flights to be flown by all four shuttles. All the 'Class of 78' women were listed to fly again, with Kathy Sullivan a crew member on the long awaited Hubble Space Telescope deployment mission. However, America's space program came to a tragic and abrupt halt on 28 January 1986 when the shuttle *Challenger* was destroyed in an explosion 73 seconds into the flight of STS 51L. Among the seven crew members killed were Judy

Resnik and teacher Christa McAuliffe.

Following the stand down of shuttle flights, Sally Ride was appointed to the Presidential Commission headed by former Secretary of State William Rogers, to investigate the disaster. After its completion in June 1986, Ride was appointed special assistant to NASA Administrator Jim Fletcher and was given special responsibility for long term and strategic planning.

This culminated in the release in August 1987 of *Leadership and America's Future in Space*, better known as the Ride Report, in which future directions for American space exploration were mapped out. This included recommendations of settlements on the Moon and an eventual human landing on Mars. To date, little of the Ride Report has been acted on.

Soon after the report's release, Sally Ride resigned from NASA and returned to her alma mater Stanford University to teach. Dr Ride is now head of the California Space Institute and serves on several government advisory boards.

Space shuttle flights recommenced in September with the launch of STS 26. The all-male crew carried the hopes of the nation (particularly NASA) with them and when *Discovery* touched down at Edwards Air Force Base in California, America erupted with joy. The shuttle program was back in operation — albeit with more caution applied, newly designed and safer booster rockets plus a host of stringent safety procedures in place.

Flying higher

By 1995, 22 women had completed space flights. Included in this number were the first black American woman, Mae Jemison; the first woman from Japan, Chiaki Mukai; and Helen Sharman, who was the first Briton to go into space when she flew aboard Russia's Soyuz TM-12 to Mir in 1991.

In January 1990, the public received an idea of the skills that it took to be an astronaut when Bonnie Dunbar captured the Long Duration Exposure Facility with the shuttle's robot arm. The retrieval made headlines throughout the world and Dunbar was widely praised for her role in the success of the mission.

Mission specialist Bonnie Dunbar acting as the communications link between shuttle Atlantis and Russia's Mir Space Station, during the STS-71 rendezvous and docking mission in 1995.

Mission Specialist Kathy ('KT') Thornton, selected as a mission specialist in 1984, played an important role in the flight of STS 49 in May 1992 when the crew retrieved and repaired an ailing INTELSAT satellite. As well, she made a spacewalk demonstrating construction techniques for the upcoming space station.

In December 1993, Thornton again played a major role in the highly successful First Hubble Space Telescope Servicing Mission. One of four astronauts to complete lengthy and arduous spacewalks to repair the faulty telescope, Thornton assisted in installing a new optical system for the myopic HST, as well as replacing faulty scientific instruments.

Kathy Thornton would also manually disengage and jettison a damaged 12-metre solar panel, whilst attached to the shuttle's robot arm. The repair mission was a triumphant demonstration of skill and perseverance.

By 1995, no woman had actually flown as a shuttle pilot. But this would change on 3 February 1995, when US Air Force Lieutenant Colonel Eileen Collins occupied the right hand seat of the shuttle *Discovery* on an eight-day mission designated STS 63. Also on the crew was Russian cosmonaut Vladimir Titov.

Collins' tasks during the mission included steering the *Discovery* by firing tiny manoeuvring rockets, and monitoring the shuttle's radar and navigation systems. She also handled the crew check systems whilst mission commander Jim Wetherbee flew the orbiter into a gentle orbit around Russia's Mir space station, in a dress rehearsal for the first Space Shuttle/Mir docking four months later.

Awarded her pilot's licence at the age of 19, Eileen Collins studied mathematics at Syracuse University and joined the US Air Force on graduation in 1978. Following basic pilot training, Collins participated in the 1983 invasion of Grenada before becoming an assistant professor in mathematics at the United States Air Force Academy and a training instructor for T-38, T-41 and C-141 aircraft.

Collins was a student at the elite Air Force Test Pilot School when selected by NASA as a pilot astronaut candidate in 1990. As the second woman (and one of only four) to graduate from test pilot school, she found a little irony in her spaceflight situation. "Ten years ago, I

STS-83 pilot Susan Still gives the thumbs-up sign after successfully completing her M-113 rescue vehicle training at Kennedy Space Center, prior to the mission. KSC instructor George Hoggard beams his approval.

was in the military, learning strategy and tactics to fight against the Russians. And here I am, an astronaut at NASA in 1995, flying into space with a Russian.... and doing a rendezvous with the Russian space station."

Well aware of her position as the first woman to enjoy the responsibility of piloting a space shuttle, Eileen Collins was also cognisant of the struggle once faced by women to become astronauts. In fact, she specifically invited the group of Lovelace Clinic women pilots to her launch. In doing this, she became the fulfilment of a promise given to these women more than three decades earlier.

Also by inviting the Lovelace pilots to her launch, Collins made the world aware of the achievements of these remarkable women who had been all but been ignored by the media, space historians and the general public.

To celebrate her flight on STS 63, Collins took along some souvenirs of pioneering women pilots, including a scarf once worn by Amelia Earhart and a pilot's licence belonging to Evelyn ('Bobbie') Trout, who was one of the first woman pilots receiving her flying licence in 1929. She also took mementos belonging to Women's Air Service pilots who had flown military aircraft during the Second World War; ironically the WAS had been headed by Jackie Cochran...

At the time of writing, Eileen Collins is scheduled for launch on 15 May 1997 on her second flight as a shuttle pilot, on STS 84 which will be meeting and docking with the Mir space station. In all probability, Collins will be NASA's first woman spacecraft commander next year.

There are now three women pilots in the astronaut corps, so having women commanding space shuttle flights will be nothing unusual in the future. This number is expected to increase in future astronaut selections, as more women are participating in military flight training and test pilot programs which are mandatory requirements for becoming a space shuttle pilot.

In April 1997, US Navy Lieutenant Commander Susan Still became NASA's second woman shuttle pilot aboard STS 83 and will be flying again in July 1997 after *Columbia* had to be brought home early after a fuel cell failure. A flight assignment is imminent for the third woman pilot, US Air Force Major Pam Melroy.

As of May 1997, 324 men and 32 women had flown into space. Of the women, there had been 25 Americans, three Russians, one Japanese, Canadian, French and British space explorers.

With the place of women now firmly entrenched in space exploration, it can certainly be said "You've come a long way baby". Just don't be too surprised when the next giant leap for mankind, on the Moon or Mars, is taken by a woman!

In closing, the authors wish to thank Geoff Allshorn, Debbie Dodds of the Johnson Space Center and Jim Elliott, for their assistance in the completion of this article. All photographs are by courtesy of NASA. ❖

THE CHALLIS REPORT

(Continued from page13)

When I looked at the authoring system's computer display, it confirmed that the input signal to the decoder was literally 'over the top'. Notwithstanding, the MPEG2 authoring system's encoded picture displayed no signs of hardship. There was no breakup into monoblocks or larger random blocks of data, which frequently occurs when a DVD decoding system's output can't cope. When that happens, you will observe a jumbled and disturbing collection of large rectangular blocks on your screen. If your DVD player cannot cope with a dirty, badly scratched, or poorly pressed DVD disc, that's what you can expect to see.

Impressive system

The software and hardware that Philips have developed for their MPEG2 authoring system is very impressive. Although the racks of equipment are small (typically one rack), and a single desk will suffice, the attached photo shows a fully fledged studio authoring facility of the type that will be purchased by large organisations and serious film producers of the type that will produce Hollywood blockbusters. The type of authoring system that most software producers will buy is relatively small, very convenient, and comparatively affordable.

Some of the software that is currently being produced overseas will involve more complex acoustical information in the form of the '5.1 channels' of audio information, in more than one language. That of course expands the complexity of the task, and the potential size and cost of an authoring system. Where the system has more than one sub-titled language (matching the audible channels), that too, expands the complexity of the system and the cost of production.

Most of the material to be produced in Australia, and in many other countries, will be considerably less complex. It won't need the degree of complexity associated with the hardware and software of the type developed by Lucas THX systems (amongst others).

One thing is for certain, the authoring systems marketed by Philips, and by its competitors in America, are now developed to the point where almost anybody who wishes to produce DVDs, CDIs, or CD ROMS, and has the resources, can produce their own software immediately.

The authoring system that Philips is installing in Sydney as I prepare this review, will be producing Australian DVD software long before you read this review.

Now that the software is in production around the world, catering for multiple interests and markets, DVD is assured a safe and burgeoning market and will rapidly grow from infancy to adulthood. ❖

A review of the

CASSIOPEIA: CASIO'S NEW BABY

Palmtop computing seems to be the go lately, with a number of companies producing their own version of the handheld personal computer. Casio's contribution, the aptly named Cassiopeia, stands out from the crowd with its stylish looks and extra features. We decided to review the Cassiopeia along with a PCMCIA modem, to see what all the fuss was about.

by GRAHAM CATTLEY

The concept of truly portable computing seems to have come of age with the introduction of Microsoft's Windows CE, a scaled-down version of Windows 95 designed specifically for handheld personal computers. It's interesting to note that the Windows CE operating system was developed well before there were any handheld machines around to actually run it on. In fact, the microprocessors found in most palmtop computers were tailor-made to run the CE operating system, which just goes to show how influential Microsoft really is...

The Cassiopeia was one of the first handheld personal computers (HPCs) to hit the American market and, after a year's delay, they've finally become available in Australia. Based on Hitachi's H3 RISC processor and supporting a type II PCMCIA slot, the Cassiopeia is available with 4MB of RAM and contains Windows CE permanently installed in 4MB of ROM.

Along with the operating system itself, you get built-in pocket versions of Word and Excel, as well as calendar, task, and contact management software. You also get a CD containing HPC Explorer, which lets you easily transfer files between the Cassiopeia and your Win95 desktop computer via a high speed serial link.

One of the major selling points of the Cassiopeia is that it is Internet ready, and that by using a PCMCIA modem you can read your email and even surf the net. With this in mind, I decided to try out the Cassiopeia with a Comport SA-MC218 28.8k PCMCIA modem, kindly supplied by Casio's Australian distributor, Mobex.

Communications

One of the first things you notice about the Cassiopeia is that it doesn't have a floppy disk drive. (It doesn't have a hard drive either, but I'll get to that later.) This would suggest that the Cassiopeia is more of a souped-up personal organiser rather than a personal computer, as any data entered into it would be difficult to extract and use on your desktop computer. This isn't true, however, as the Cassiopeia is in fact a full blown computer, and has not one, but *three* different ways of transferring data to and from other systems.

The most obvious of these is the Type II PCMCIA slot on its right side. The other two are a custom serial port hidden behind a small flap on its left side, and an adjacent IrDA infrared port that allows it to communicate with other HPCs. As it happened, I had access to another HPC manufactured by LG Electronics, and so was able to try an IR file exchange between the two. After I highlighted a file in the Cassiopeia and selected 'Send' from its file menu, it sat there waiting for a response from the other computer. I selected 'Receive' on the other HPC and aligned the IR ports on both machines so that they faced each other. Within a few seconds the file was transferred — and all without cables, disks or contact between the two machines.

The Comport PCMCIA modem is shown here with its plug-in telephone cord attached. It can handle speeds up to 28.8k, and can be used with mobile phones to make a truly portable setup.

Hidden away around the side of the Cassiopeia is yet another comms port that allows the Cassiopeia to exchange data with other digital equipment. This is a 3.5mm stereo socket, but details on this port were a bit sketchy, and I could only find a brief mention of it in the manual where it informed you that you would need special software in order to communicate with a Casio QV digital camera. Quite why you'd want to transfer images from a camera into your Cassiopeia is beyond me, as its 480 x 240 display can only display four shades of grey, and I don't think the results would be very satisfactory.

As I said before, the Cassiopeia doesn't use a hard drive; instead relies on a RAM (lithium battery backed) to store all your files and settings. The programs themselves are stored in ROM, and so you have a potential 4MB to divide between system RAM and file storage. If you decide to install some extra applications (the CE version of Internet Explorer for example), then you may have to eat into some of the available RAM to make room. Using a simple slide bar interface, you can allocate different proportions of the available space between drive space and available RAM. This defaults to a 50/50 split that gives you 2MB for available RAM and 2MB for file storage, which seems to work well.

More power!

Surprisingly, the Cassiopeia runs on only two AA alkaline batteries, and these will last around two to three weeks with normal use. Battery life is severely shortened, however, when you try run-

The Cassiopeia uses a 117 x 60mm touch sensitive screen for the user interface instead of a mouse. It is also one of the few HPCs on the market that provide a backlight screen — perfect for playing Solitaire in bed.

ning the Cassiopeia with a PCMCIA device, such as a modem.

I was quite surprised to find that the Cassiopeia's current consumption was maintained at 1mA when the unit was turned off. This current drain was presumably for the battery backed RAM, and would mean that the batteries would need replacing on a regular basis, whether you used it or not.

I measured the current consumption of the Cassiopeia (without the modem) at 65mA. The supply current rose to 275mA whenever the Cassiopeia was processing input, or when the screen was touched with the stylus. This was obviously a sleep-between-keystrokes power saving system as used in many laptop computers, and would explain the long battery life.

This current jumped to over 600mA (and peaked at over 1000mA) when the modem was installed and running. Within a minute, a pop-up window informed us that the main batteries were getting low and would need changing. Of course, if you have the backlight on you can add an extra 100mA to all of the above figures.

With such a high current drain, you couldn't really consider using the Cassiopeia with a modem without some form of external power, such as a plugpack.

Unfortunately, the Cassiopeia doesn't have the usual DC power socket found on most pieces of electronic equipment, and so the only way to power it is with batteries or a specially designed docking station. This docking station is available from Casio for $90, and you will also need to buy the matching plugpack for a further $90.

A bit pricey perhaps? Well, when you compare it with the Cassiopeia's $999 price tag, perhaps not...

Cassiopeia A-11

A hand-held personal computer running Windows CE. It comes with 4MB RAM, and a backlit 480 x 240 touch screen.

Good points: Nice sensitive touchsreen, reasonably robust, same price as other models that don't include a backlight.

Bad points: You have to buy a docking station in order to run it off a plugpack.

RRP: The Cassiopeia A-11 is $999, or $899 for the A-10 2MB model. The docking station is $90, and the matching plugpack $90. The Comport SA-MC218 28.8k PCMCIA modem is $595.

Available: The Cassiopeia is available from most Brashs stores, and other major electrical retailers. More details on the Cassiopeia and on the availability of the Comport modem are available from Mobex Pty. Ltd., 72-74 Gibbes St., Chatswood NSW 2067. Phone (02) 9370 9100.

What's inside?

Of course, being an electronics enthusiast at heart, I couldn't resist opening the case to see what was inside, and I was quite surprised at the small number of ICs on the single PC (mother?) board.

There was the Hitachi H3 CPU, plus two large custom chips manufactured by Casio — one of which was the display driver, the other being the ROM. The only other ICs were a small 16-pin device and two 1MB RAM chips. The extra 2MB of RAM was mounted on a small removable PCB, accessible via a removable cover on the back of the Cassiopeia.

The rest of the main board was taken up with a forest of SMD components and a number of rather large inductors, obviously part of the power supply.

Once I'd re-assembled it, I decided to run the Cassiopeia from a 3V power supply connected to the battery terminals, so that I could try out the modem for more than a couple of minutes at a time.

I had planned to use the Cassiopeia to connect to the Internet, and so the first thing to do was to install Pocket Internet Explorer. This is supplied on CD, as part of the Microsoft Windows CE package. At this point I was well and truly stuck, as it turned out that I needed Windows 95 on my desktop machine in order to install HPC Explorer. Here at *EA* we run Windows 3.11 on all of our office machines, and so I had to try again on my Win95 machine at home.

Having installed HPC Explorer on my home computer, I was then able to use it to install Pocket Internet Explorer onto the Cassiopeia. The whole procedure was fairly straightforward, with HPC Explorer showing the directory structure as though it were a remote drive. (Which indeed it was.)

Once Pocket Internet Explorer was installed on the HPC, I set it up with the usual DNS and IP address information as well as the telephone number of my ISP.

Internet in a box

With the modem installed into my jury-rig setup, I was able to log on to my ISP and start surfing the Net.

Surprisingly, web pages don't look that bad on the Cassiopeia. In fact the translation to a 480 x 240 pixel display works quite well, with a 640-pixel wide page scaled to fit into the 480-pixel screen. Yes, the graphics do suffer a bit, and fine bitmapped text is difficult to read, but on

(Continued on page 78)

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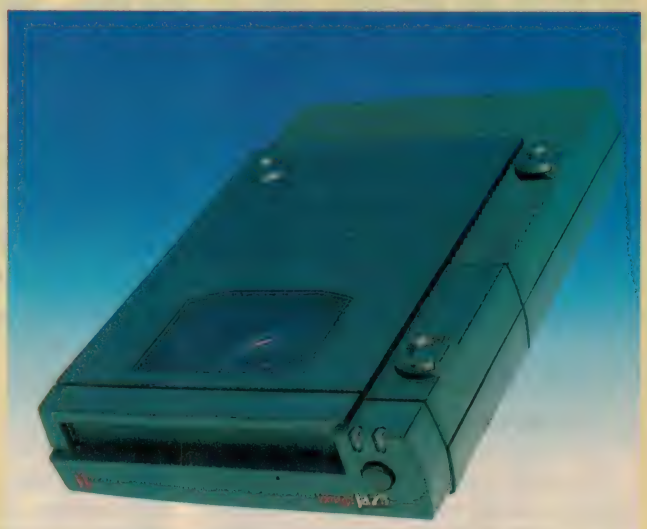

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RECENT DEVELOPMENTS IN SMART CARD TECHNOLOGY

Smart cards, with their embedded microcomputer chips, are now being applied to a large number of applications in areas such as banking, public transport, telecommunications and personnel control. Many of these applications are demanding more and more 'intelligence' in the embedded micro — to provide features such as higher security encryption or 'contactless' operation via RF interrogation — plus at the same time lower cost, in view of the huge volumes needed. It's posing great challenges for firms making the chips for these cards, as this article explains.

by DR JEAN-PIERRE BENHAMMOU

Director Secure Memory Division, Atmel Corporation

The smart card is now a worldwide business. Every country in the world is being touched by this technology. This business is currently increasing at a tremendous rate: close to 50% per year. In a few years, almost every citizen on this planet will own between one and five smart cards. Each new application requires more and more features from the card's inbuilt chip, on a die size which cannot exceed 25mm^2. 'High Tech' is on the move to satisfy this incredible demand, and this is just the beginning.

Atmel is one of the major players in this market, as a silicon designer and manufacturer. In this article, we will mainly look at the technology advances from a silicon manufacturer's point of view.

Why smart cards are high tech

To fit what is essentially a full computer, including the power supply for RF devices, into a plastic bank card and be able to bend the card without damaging it, is quite an achievement. No other electronic application requires so many functions in such a small area, and at a very low cost...

Here are three main reasons why technology advances are so important in this new field of applications:

1. The world demand for cards is increasing at about 50% compounded per year. To develop new applications with very high volume, involving a large portion of the population, the price per card should be low. Table 1 shows the market expansion. To sustain market growth and price decline, only technology advances will help achieve optimized design solutions, manufacturing miniaturization and yield improvements.
2. Both complexity and number of functions on a chip are increasing with new applications: high security cards for banking operations, communications (Internet commerce, pay-TV), multi-application (university), biometrics, the list goes on...

The latest GSM or bank cards require:

- 8 or 16 bit microcontroller
- 10 to 16K bytes of ROM or flash memory to store the software application
- 8 to 12K bytes of E^{2}PROM for data
- 256 to 640 bytes of SRAM for computation
- A coprocessor (crypto-engine) supporting 512- or 1024-bit RSA encryption/decryption operations
- ISO 7816-3 serial I/O interface circuitry
- Security features to avoid attacks

3. There is a growing need to package increasing die size reliably. The demand for new and more sophisticated functions on the same chip grows faster than silicon manufacturers can

A demonstration of just one of many potential uses for smart cards: keeping track of in-warranty servicing for vehicles. Each vehicle would have its accompanying card, easily read and updated from a PC via a small reader. (Courtesy Atmel Corporation)

implement these functions on a constant die size basis.

The lithography and the technology to manufacture smaller geometry continue to improve at a fast pace: from 1.8-micron technology three years ago for CMOS with E²PROM to 0.6um now. But the smart card industry is demanding new functions faster than the miniaturization can advance; the packaging industry needs to embed larger die reliably.

Improving silicon density

The requirement to increase the silicon density is twofold, involving both economics and the growth in complexity on the same die size.

To allow a very wide spread application like telephone, loyalty, health or bank cards, the silicon die should be a very low cost one. To decrease the price, the die size should decrease.

We have seen important improvements in the lithography and means of production in the last few years, and the race to improve them is continuing. Three years ago, CMOS transistor chips including E²PROM technology were at the 1.8um level, and today the state of the art is at 0.6um. It will be possible to reach 0.5um in 1998 and 0.35um by the year 2000.

(Please note that, due to the process complexity involved in adding E²PROM on the same die, the design rules for this type of CMOS device cannot be as tight as the ones for CMOS on a purely digital circuit).

Another factor driving an increase in silicon density is the need to provide new functions, additional security and flexibility to the customer. Crypto processors, needed for security, use flash E²PROM memory instead of ROM, or in addition to ROM.

Segment	1996	1998	2000
Banking	52	115	380
Health	12	85	260
Leisure	10	80	250
ID	15	60	250
Phone	420	720	1200
PayTV	16	40	90
Public Transport	12	35	115
Loyalty	32	80	160
GSM	12	35	85
Access Control	14	30	80
Others	60	100	150
Total	**655**	**1380**	**3020**

Table 1: Projected market expansion for smart cards. Note that the numbers denote millions of cards. (Courtesy Atmel)

The banking industry as well as new applications like commerce via the Internet require higher security. It is now necessary to authenticate the owner of the card to perform some transactions. This authentication or digital signature will be possible with the use of high performance cryptoprocessors supporting up to 1024-bit RSA operations. High security ID cards using biometrics technology will require them also. These cryptoprocessors use as much real estate on a silicon chip as the 'regular' processor which performs all the routine computations.

A further factor driving towards higher chip density is flexibility. In its microcontroller family AT89SCxxx, for example, Atmel is replacing the traditional ROM memory with a flash E²PROM memory. As a result customers may now enjoy several advantages and flexibility features:

- Because flash is more secure than ROM, the program (application software) cannot be decrypted
- Flash provides high flexibility during the development time: if an error is made, there are no additional costs or delays to redo a ROM mask. The flash memory may be erased and reprogrammed. When time is a crucial element in winning a market, this is a major feature. Prototyping and pre-production are 'flash' fast!
- Flash makes procurement easier. A customer can procure a volume of the same part and 'personalise' them at the time of delivery for a specific application.

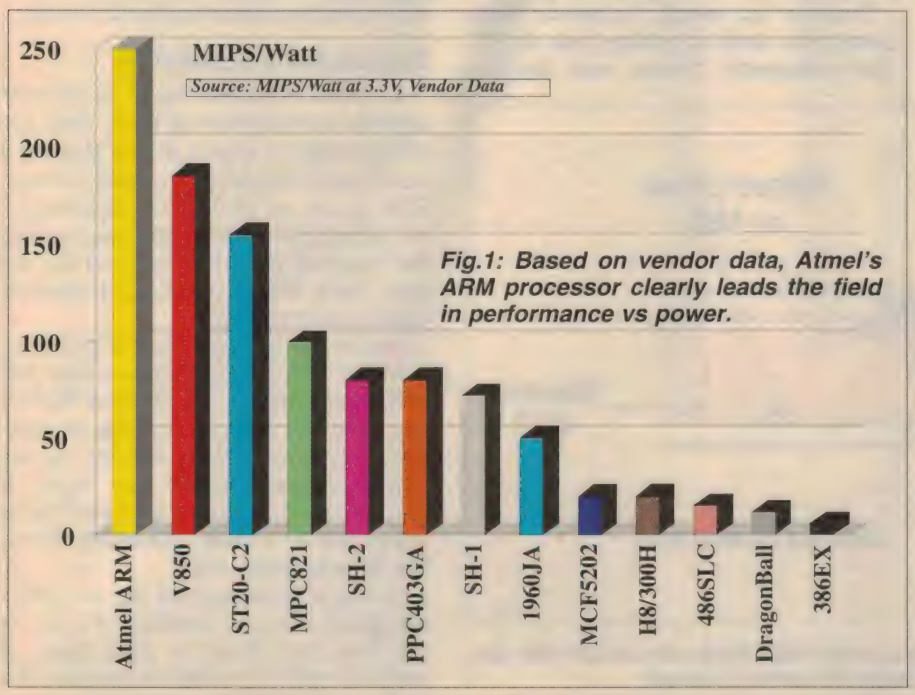


Fig.1: Based on vendor data, Atmel's ARM processor clearly leads the field in performance vs power.

New architectures

The 6805 or 8051 architectures used until recently in smart cards do not perform well enough in terms of power used, size of the cell on a chip or rapidity of executing instructions. As a result new architectures are coming up using less power and less real estate on a chip. They are also an order of magnitude faster.

Examples of these new MCUs are Atmel's AVR 8/16 bit microcontroller and the ARM 16/32 bit controller. These new processors are first choice when they are used with a cryptoprocessor for security, performance, power and chip area.

The AVR 8/16 bit RISC system is an Atmel proprietary new generation architecture. Its main features are:

- Highest performance 8-bit MCU: 10 times faster than the 8051

- Real RISC architecture: 32 registers, two-address, single cycle execution
- Low power — crucial for RF operations
- 8M byte direct address reach
- Efficient C language code density

The Atmel ARM7TDMI is a 16/32 bit RISC MCU that provides high performance at high frequency or standard performance at low frequency, thus there is very low power consumption. It could be used efficiently on a system using a battery operation or with RF operation. Atmel believes it is the best combination of low power consumption 32-bit performance and 16-bit system cost. The main features of this processor are:

- Small real estate on silicon
- Market leading MIPS/watt characteristics
- Internal 32-bit address and data bus
- 32-bit instructions are fetched in a single cycle
- Advanced Power Management Control
- Low power internal bus architecture
- Uses Atmel's low power technology
- Suitable for RF operations

Fig.1 shows how the Atmel ARM processor leads the field in performance (MIPS — millions of operations per second) versus power consumption (watts), based on vendor data.

Contactless cards

In addition to all of the previous functions, the integrated circuit for a 'contactless' smart card may have its own RF receiver/transmitter circuitry. An appropriate antenna is connected to the circuit and embedded in the card.

The contactless smart card business is increasing at a very rapid pace and this technology may be applied to all types of applications. Contactless cards usually cost more than the contact cards, because the extra functions on the chip and the antenna/packaging cost more than the contact assembly.

Contactless cards are very efficient where transaction processing should be fast due to the flow of people. Examples are bus and train fare collection, ski lifts, access control and so on.

Many other applications may be found: banking, network computer access, cafeteria, ID control for conferences, multi-application cards, material control on a production line etc.

Because the energy to power these contactless cards is coming from the RF electromagnetic waves used for the transmission, the power management is critical. It is necessary to count every microamp! The latest design methodology and the new microcontroller architecture are now a must. Atmel plans to use its AVR and ARM processors, with very low power CMOS, flash, E²PROM and SRAM memories in contactless card devices.

Packaging also plays an important role in embedding the antenna in a contactless card. About 200 turns of copper wire are required for a low frequency transmission (125kHz will allow detection up to 1m distance), while about five turns of copper are needed for a high frequency transmission (13.56MHz will allow distance detection up to 10cm).

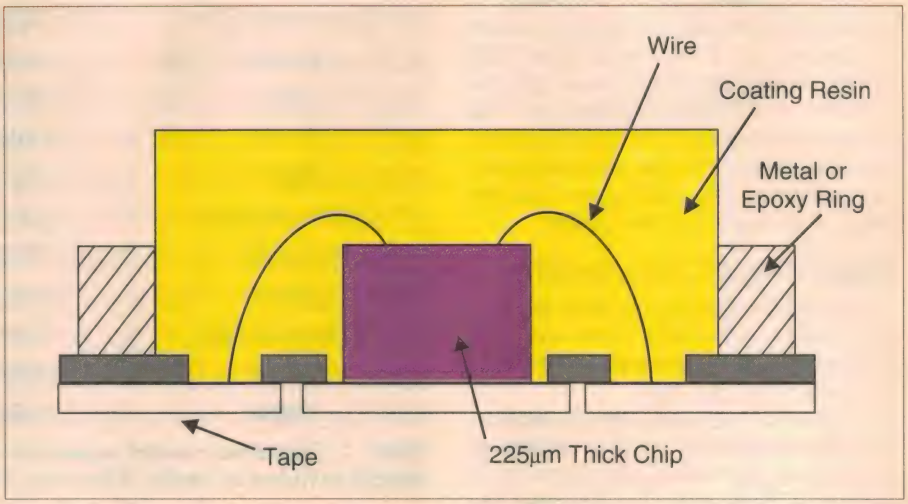


Fig.2: To ensure card reliability, the chip can be encapsulated in an epoxy-filled 'dam'. (Courtesy Atmel)

Improved packaging

As a rule of thumb, based on our production and delivery of more than one billion cards to date, a silicon chip for a smart card should not exceed 25mm². This is not an ISO 7816 requirement, but with larger chips a card may not pass the standard reliability test and the die may crack due to mechanical stresses: torsion and bending.

Due to the high pressure to add more memory for software applications and more computing power for data encryption, the die size is tending to grow faster than the silicon density can be increased. As a result new ways of encapsulating a die in a card need to be developed to ensure reliability. Some are already on the way:

1. Using a 'dam' around the die: After die attach and wire bonding of a die on the film lead frame, a dam made of metal or epoxy is added to surround the

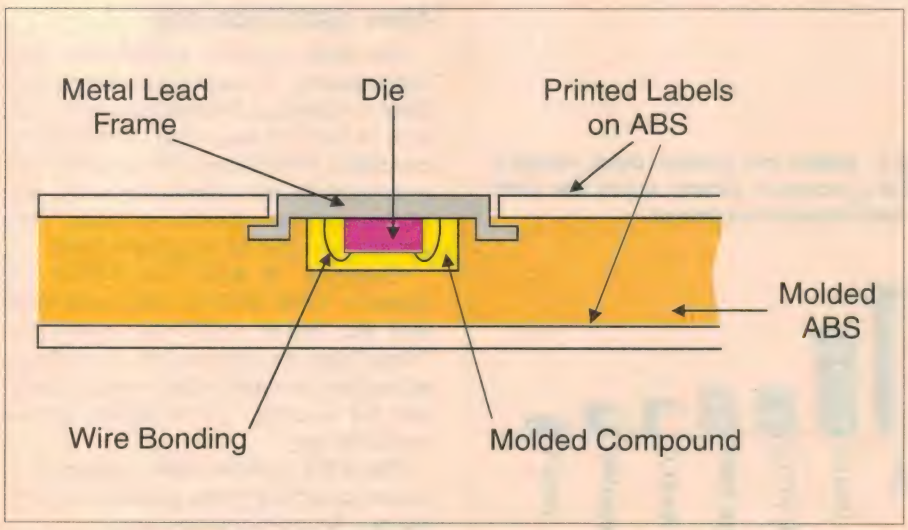


Fig.3: An alternative approach is to use a metal lead frame to protect the die, and mould the card around the micromodule. (Courtesy Atmel)

die and its connections, and then filled with epoxy. This process brings rigidity to a large die assembly. (See Fig.2)

2. Using a metal lead frame and moulded compound to protect the die mechanically before encapsulation. The ABS plastic forming the plastic body of the card is then molded around the micromodule (Fig.3). This is the closest way of manufacturing a smart card to classical integrated circuit packaging.

3. Use of different substances for the body of the plastic cards: PVC, ABS, polycarbonates, or any combination of these materials. The body of the card will keep the die area rigid and provide support during flexions and torsions of the card.

PVC yields excellent printing and embossing capabilities, but presents a serious hazard for the environment. Printing on ABS has made great progress in the last two years and printing quality is close to that of PVC.

Equally important is to be able to print cards very fast, in limited quantities, with a lithography quality. Advances in digital imaging and data management (large image files for lithography quality) will allow for printing four-colour high resolution images as part of the in-line card personalisation process.

About the Author

Jean-Pierre Benhammou holds BS and MS degrees from the University of Marseilles in France, and a PhD in solid state electronics from Montpellier University. He has worked at Atmel Corporation in San Jose, California for eight years, and is currently the product marketing director for Secure Memories. This position involves responsibility for new product definition, technical and strategic marketing, product management and sales for all secure memory and E^2 logic devices. Jean-Pierre has over 27 years' experience in the industry, in various marketing and sales positions. Before joining Atmel he held positions with Texas Instruments and Honeywell.

Conclusion

Smart card technology is on the move and will continue to accelerate in response to continuing demands for more functions at lower costs. New and fascinating developments continue, on every aspect of the smart card technology: silicon design and manufacturing, packaging, software for applications and many other aspects that are limited only by our imagination.

It is a very exciting business and will serve people's needs. Soon, everyone on this planet will be using these smart cards, and that provides a huge opportunity for companies with established skills in the technology. ❖

THE SERVICEMAN

An old reel-to-reel tape recorder that was just too frisky!

One of our stories this month comes from a reader in Condobolin, NSW and involves the fun and games he had in trying to get an old Revox tape recorder working correctly. There's also a puzzling tale of an elderly valve TV set which simply didn't like one brand of valve...

We open this month's column with a story about a sophisticated tape recorder, a relic from the days when cassettes were definitely lo-fi and even LP's left something to be desired. I still own a big four-track open reel recorder from this era and I hope I never have to work on it like our contributor this month.

The story comes from Robert Abel, of Condobolin in New South Wales. As you will see, Robert bought the machine in 1969 and it has given stirling service, until just recently. This reinforces my frequent claim that if you buy top quality, you are likely to get long and trouble free service.

Here's what Robert has to say...

During the years 1958 to 1969, my brother and I operated an automotive repair and service garage in a small country town in western Victoria. After my brother left to seek greener pastures, the business became somewhat of a burden and I eventually leased it — with a sigh of relief — to concentrate on my radio, electrical and hardware business.

As a reward for 11 years of unpaid toil, I shouted myself the best reel to reel tape recorder I could find at the time — a Revox model 77. It was a fairly sophisticated example of its class, having both 7-1/2 and 3-3/4ips speeds (that's 'inches per second' in old money — Ed.), *controlled by a then-new type of capstan motor with excellent speed regulation.*

When I eventually closed my own business in 1972 and left Victoria by car and caravan, intending to see a lot of Australia, the caravan carried my prized Revox and a heap of tapes, some bought and some home recorded. Then when I finally took root here in 1975, the Revox and tapes became part of the hifi setup in my new home.

For many reasons my equipment did not get as much use as formerly, and one day I noticed that the pressure roller on the Revox had hardened and cracked badly.

When I had bought the machine, the Australian agents for Revox were AWA Ltd, and so I contacted them for a replacement part. I had also purchased a Service Manual and so was able to quote the original part number.

AWA had since relinquished the agency and gave me the name of the new distributors, who were delighted to quote me $85 for a genuine part. When I had got over the shock, I decided the old machine was worth the cost and in due course I received and installed a new roller.

I sat down to enjoy a session with those tapes that I hadn't been able to play for all those years. And enjoy them I did, for maybe 15 or 20 minutes!

Then there was a mighty 'bang!' from somewhere inside the machine, and to be honest I'm not sure whether the machine stopped by itself or I managed to get there first!

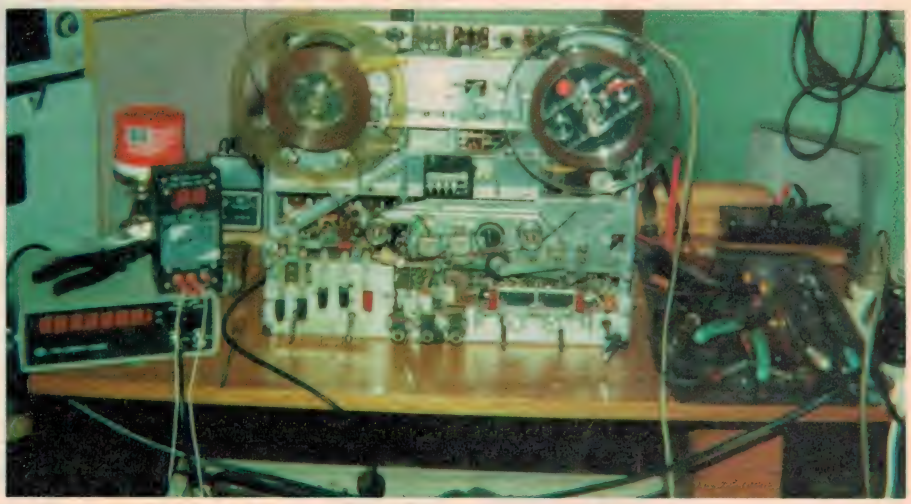
Minor explosion

The cause of the noise was evident once the back was off. A condenser had exploded (Sorry, Robert. They're 'capacitors' these days!) *on one of the control boards — a 0.47uF 150VAC type, of which there are a number used in these circuits. I did not have an exact replacement, so used a high voltage DC type as a temporary measure with no apparent ill effects.*

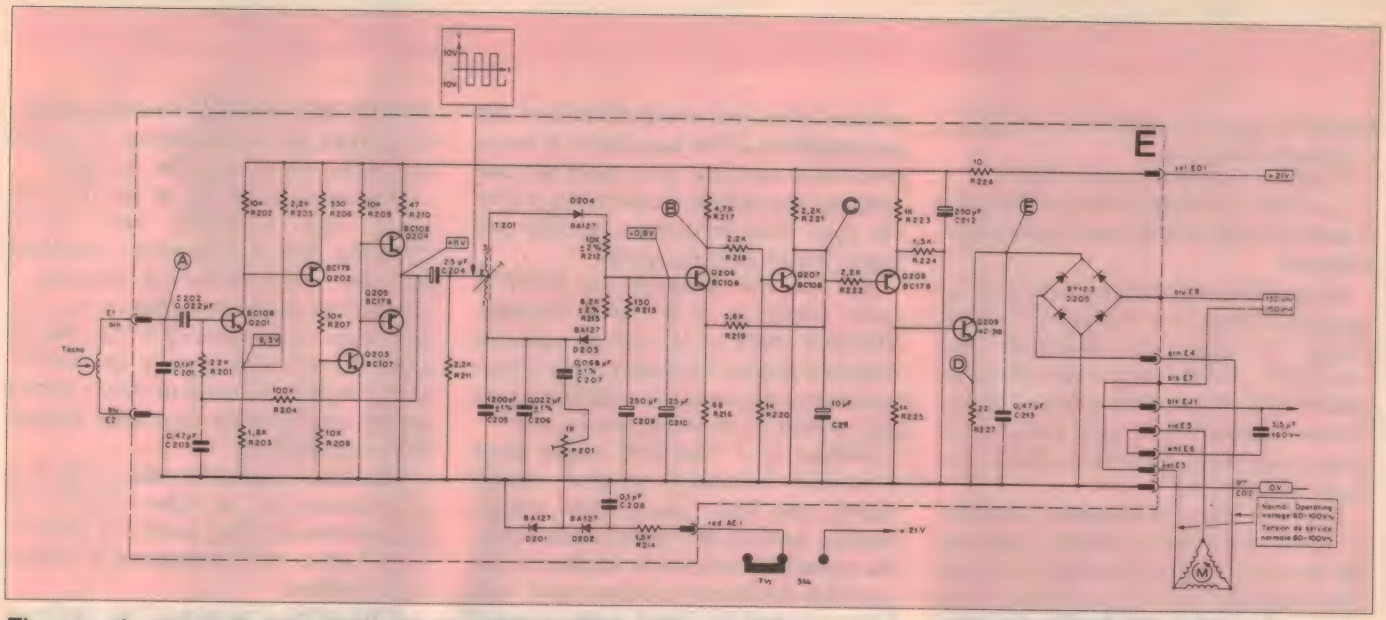
However it was evident that all was not well with the tape speed control and I was faced with removing the appropriate board, which proved to be attached to the main power transformer! At this stage it seemed best to order some proper AC type 0.47uF capacitors — as I was convinced that the rest of these might 'go' at any time.

On inspection, I also could see that all the small electrolytics in the other boards had done what all electrolytics do after time — dried up, and in some cases, burst. So I ordered some of those also!

Here the Service Manual was invaluable; as well as 40 pages of detailed instructions and descriptions, it has 10 fold-out pages of the various boards, record preamplifier, replay ditto, power



Robert Abel sent this photo of his Revox 77 tape recorder, removed from its case, while it was undergoing testing and repair. It's very solidly made.



The speed control circuitry for the Revox 77 recorder, taken from the service manual. The output signal from the tacho generator (left) is amplified and fed to a frequency discriminator (D203, 204); the error signal is then amplified to drive the capstan motor (lower right).

supply, tape speed control, etc., followed by a further series of illustrated parts lists. The fold-out pages have photographs of the boards overprinted with component numbers (C205, R342, etc), as well as the actual circuit diagrams.

In order to get at the fixing screws for the transformer, I had to remove both the upper (plastic) front cover plate and the lower metal one, but it was then quite easy to remove the screws. The real trouble came in trying to juggle the transformer into a position where I could reach the retaining screws for the speed control board. This was eventually achieved and the board removed. (I later found it quite easy to remove the board without the transformer, but the manual had no instructions for this board, unlike most of the others.)

The symptoms of trouble with the tape control were of a large increase in capstan speed, so that tapes recorded at 7-1/2ips were only sounding approximately correct when played with the switch in the 3-3/4ips position. As can be seen from the diagram, tape speed is set by a series of 1% capacitors. One of these would have made a convincing resistor, while another was well outside its stated value.

Control of the capstan speeds is achieved by deriving pulses from a row of slots precisely machined into the rotor of the capstan motor and it is the frequency so derived which is monitored to enable the speed to be set by adjustment of the core of the discriminator coils — for 7-1/2ips — and of a preset resistance in series with the 1% capacitor used to lower the speed to 3-3/4ips.

While testing the various components and assiduously studying the description of its operation, I could see that any repair or replacement would necessitate the resetting of the speed of the capstan, for which a frequency counter was specified.

Now, I had long been looking for an excuse to construct the 1GHz frequency counter, and this seemed to be it. So the Revox had to come off the bench while the counter was constructed and this went on for quite some time! (Oh for the days when I was paid to do these things, and could work full time on them!)

Measurement time

I won't go through all the false starts — mostly due to solder dags — but the project had to be put to one side several times because of other committments. But when I finally got back to the workshop a few weeks ago, everything fell into place and I was ready to start measuring frequencies — 1600Hz for 7-1/2ips and 800Hz for 3-3/4ips. And after some replacing and padding of values, the speeds were very close to right.

Unfortunately, they wouldn't stay that way. They went up and up, and the control transistor was dissipating too much power and getting far too hot! Out came the board again, and orders went away for more low-leakage components. On the next reassembly, with all new capacitors of measured values, both the 1600Hz and 800Hz were rock solid and what's more, the music was sounding the way it should.

The only remaining things needing replacement are the tape counter drive belt, and the 'Power On' lamp. The latter is a 36V type, so reluctantly I went non-standard, and substituted a red LED. I guess I will really have to send away another order — for a belt — so I can find the music I want to hear.

And yes, I do have a CD player. But these old tapes are something else! Truly!

I think I may have run on quite a bit, in my enthusiasm at finally completing what should have been quite a short job. But then, I don't often get the chance to work on really 'Top End' equipment.

You did 'Run On' a bit Robert, but I reckon you're entitled to do so. Anyone can find and replace a blownup electrolytic, but not often do we have to build special test equipment to finish the job!

And I'll bet you blessed yourself for buying the service manual all those years ago. I don't have a manual for my big Akai, and I'll be in trouble if I ever have to repair a fault anything like the one you found.

Thanks for that story, Robert. Your contributor's fee will perhaps buy you some new tapes for the Revox.

Now, the mystery

Now we turn to another contribution from an old friend — Peter Lankshear, former author of the Vintage Radio column in this magazine. Nowadays he keeps his word processor warm by writing occasional stories on servicing old radio gear, lucky for us. This story is a little out of the ordinary, since Peter here talks about servicing an early television set. He calls his story 'A Mystery Fault':

In my experience there are four

essential steps in successful servicing of a fault. They are:
1. Confirmation that a fault exists;
2. Location and identification of the fault;
3 Analysis of the original cause of the fault;
4 Repair.

Most of us adopt this procedure automatically. Step three is the point where design or component weaknesses are identified, and the step is necessary to ensure that the problem will not recur. It was my inability in one situation to completely satisfy step three that is the basis of this story.

Since the dawn of consumer electronics, kitsets have been available. They satisfy the urge to make things and they provide integrated sets of guaranteed components for projects. With a kit, constructors can usually be confident that there will be a reasonable chance of success.

In the past there could also be considerable savings in cost at a time when, by today's standards, equipment was very expensive. Furthermore, the 'hands on' experience provides an excellent learning situation.

In the early days of radio, receiver kitsets were the most popular, but by the 1950s any saving over buying a manufactured radio was marginal. However, some monochrome TV kitsets, generally based on designs appearing in magazines such as our predecessor 'Radio TV & Hobbies' were becoming available.

Although sources of designs were usually hobbyist magazines, there were some specialist kitset firms like Heathkit who provided both designs and components. Established receiver manufacturers usually avoided kitsets as being far more trouble than they were worth, and a counter to their own enterprises.

It is surprising then that no less an organisation than Philips New Zealand should market television receiver kitsets during the mid 1960s. Their first effort was a limited number of a hand-wired models, but their major kitset was the SD23CX, intended for advanced experimenters and professional electronics technicians.

The SD23CX was a very sophisticated 19-valve model with such features as three video plus two audio IF stages, a discriminator sound detector and flywheel sync. Standard Philips components were used and although their normal practice was to use transformerless power supplies, the kitset came complete with a mains transformer.

There was a choice of 19" or 23" picture tubes, but the cabinet was the responsibility of the purchaser. It was a first class receiver, and when up and running, the SD23CX could foot it with the best, both for picture quality and stable fringe area reception.

Just how the design for the SD23CX came about is a bit of a mystery. Although much of the circuit reflected standard Philips technology, the physical construction was quite different from any of their local production models.

Instead of a standard single large vertically mounted printed circuit board, the kitset used three circuit boards, horizontally mounted in a neat but complex framework. As there is no way that development costs could have been covered by kitset sales alone, I suspect that the design was derived from an overseas model or possibly from one that for some reason did not enter local production.

During 1966, a good friend of mine and I decided that it was time for our families to have TV receivers. By today's standards, even 'bottom of the market' receivers were extremely expensive and I looked closely at the Philips kitset, which was available at a fraction of the cost of a made up set.

Two kits were duly purchased and assembled. The finished results were quite up to expectations and for about 10 years of extensive use, the two receivers provided practically flawless service. About the only problem was the failure in my set of the ECL85 vertical output valve.

Colour TV arrived in the mid 1970s, and we duly placed our monochrome receivers in honourable retirement. My friend then suggested that it would be a good idea if, after an overhaul, his old set was given to a charitable organisation. I agreed and although it was working quite well, I blew the dust off his old faithful to measure a few voltages etc.

First, though, I followed standard procedures and tested the valves. About the only one that measured a bit low was the ECF80 horizontal oscillator/reactance control valve (V15A and V15B). A replacement AWA (not AWV) Radiotron was fitted and after a few tweaks, the receiver appeared ready for a new existence.

I put the set to one side, informed the appropriate organisation of its availability and a few weeks later, duly received a request for a TV set. Fortunately, before delivery, I switched it on to give it a final 'workout'. To my surprise, after about 15 minutes, the picture broke up — displaying the symptoms of an out of sync line oscillator.

This was a surprise, as the line stability was normally very good. Thinking that my previous checking had not been thorough enough, I checked to make sure that there were zero volts on the grid of V15B; but all seemed well. The setting up instructions, in fact, covered in detail setting up the oscillator for operation in deep fringe conditions.

This was repeated but during the first 10 minutes or so after switch on, despite the set being used in a primary signal area, there remained a serious drift problem.

A frustrating aspect of the problem was that the very purpose of the complex design of the oscillator was to retain synchronisation under conditions of fading, weak signals and mutilated sync waveforms. Normally it performed extremely well. The only thing that I had really done was to change a valve. By now the original valve was in the waste bin, so I tried another new Radiotron ECF80 — but with no improvement.

Getting serious

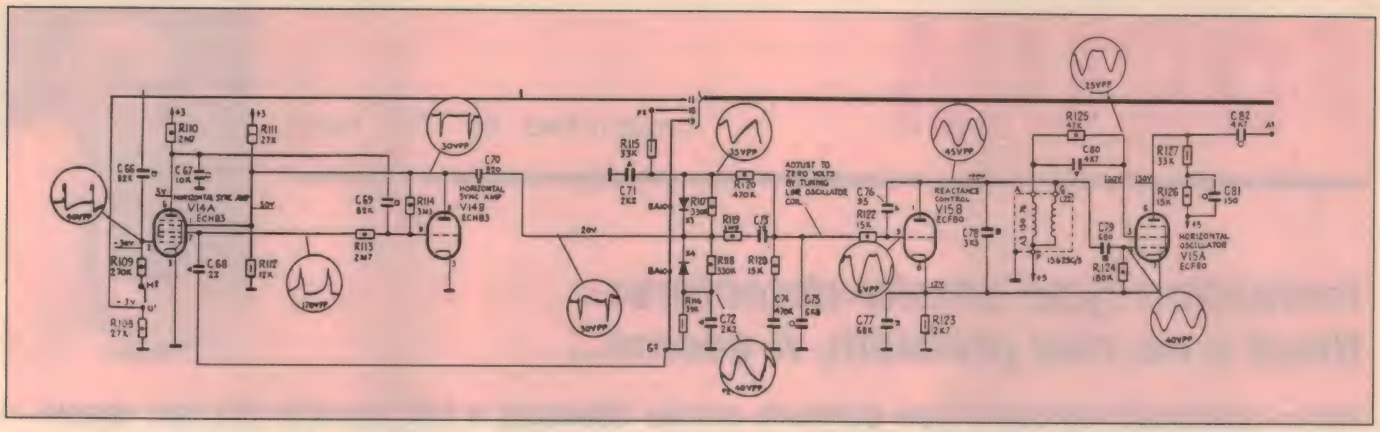
The time had come to get serious, so I fired up the oscilloscope. Waveforms and their voltages from the sync separator onwards were correct. Fortunately, I still had my own receiver; but the old trick of a side-by-side comparison revealed nothing amiss. Clearly something in either the reactance control or the horizontal oscillator itself was drifting.

As printed circuit boards don't take kindly to unnecessary soldering, I was reluctant to chop the circuit around to try and localise the culprit; but I did try replacing the oscillator tuning capacitor, a 3.3nF polystyrene type. This was no help at all. I even tried interchanging the ferrite tuning slugs!

Then in a fit of desperation, I tried the Philips ECF80 valve from my own receiver and this seemed to cure the problem. A few swaps, including operation in my receiver, confirmed that it was indeed the Radiotron valves that were the culprits!

The remedy was simple. The offending replacement valves worked quite happily in other parts of the set, so I exchanged one with an IF amplifier and there were no further problems.

Certainly, the fault was cured — but rule number three was not satisfied. I



The horizontal sync, AFC discriminator, reactance tube and oscillator circuitry of the Philips SD23CX monochrome valve TV receiver, sold in New Zealand as a kit in the 1960s. It just didn't like AWA valves!

still did not know the reason why the Radiotron valves acted as they did, so when time permitted I experimented further on my receiver. As well as Radiotrons, I was able to try Philips, Siemens, Telefunken and Raytheon ECF80/6BL8 types, as well as an industrial E80CF valve. All of the latter worked perfectly — only AWA Radiotrons showed the problem.

Tested in an AVO MkIV valve tester, the parameters of all makes were close to specification and anode currents and transconductance of the offending valves stabilised quickly. Certainly nothing took anything like 10 minutes to settle down.

If I had not been able to confirm in my own set that the problem was a valve, I would have put it down to an out of spec component. Being a double valve it was not readily possible, without some drastic wiring surgery, to positively identify the culprit as being the oscillator itself or the reactance valve.

To this day, I have no convincing explanation. I can only assume that some obscure quirk, such as minute traces of gas or water vapour, caused the drift in characteristics, but this would not be likely in two valves.

This was in the twilight of the valve era, and with rationalisation of manufacturing, valves came from some strange sources. RCA branded valves for example, originated in Brazil, Chile, Mexico, Britain and Italy, and the two AWA labelled valves at the centre of this story were made in Japan. Consequently, although their brands appeared on valves, suppliers did not have much control over their manufacture. I eventually gave up, leaving a mystery that is unlikely ever to be solved.

Thanks for that story, Peter. As much as a tale about valves, it's a salutary lesson in soak testing. I can't think how many times I have soaked a set just five minutes less than the time necessary to reveal a hidden fault! Even if I give it five minutes extra, just to be on the safe side, it's still five minutes less than the set needed to spit the dummy.

You were lucky you didn't get caught with this set. Even a charity getting a TV for nothing would still be a bit peeved if it started playing up that very night.

That reminds me...

Actually the valve side of Peter's story reminds me of a similar tale told in these very pages, years and years ago. In fact, it was the November 1978 edition, wherein the then Serviceman told of an AWA portable monochrome TV that led him through all kinds of trouble before the fault was nailed down.

It seems that the set came in with a small, dark picture and the cause was correctly diagnosed as a weak 6CM5 line output valve. The Serviceman replaced the valve, which produced a full size picture, but one that was overbright and excessively contrasty.

When he turned down the brightness, the picture lost sync and became torn to pieces. The same effect resulted when he reduced the contrast.

He spent a long time testing voltages, resistances and capacitances, all without success. The original valve produced a stable but small picture. The new valve corrected the size problem but destroyed the picture sync...

To cut a long story short, he was eventually able to query a colleague about the fault and was told that he was using a Philips brand valve. The colleague suggested that he replace the new Philips valve with an AWV type, which should cure the problem. It did!

They were quite unable to explain why one brand worked and the other didn't — since, as we had been led to believe, a 6CM5 is a 6CM5. However, in this case as in Peter's story above, there can be some differences between brands that can destroy a set's stability.

Obviously, the AWA set was designed around AWV valves, and the Philips design around Philips valves. So any differences in the valves would have been accommodated in the set design. However, it does suggest that the designs had a very small margin of safety in their parameters. If it won't work with a nominally identical valve, it must be running very close to its design limits.

In fact, the same kind of problem is showing up in transistors. Some TVs will only work if the 2SD380A line output transistor is a particular brand — usually the same as the set's manufacturer. Nominally identical transistors, from other makers, are unreliable if they work at all.

It's a funny business, and one I won't even try to explain. Not this month, anyway! ❖

FORUM

Conducted by Jim Rowe

Ionisation type smoke detectors: there's no real problem, it seems...

We've discussed ionisation-type domestic smoke detectors a few times in the last couple of years, and various questions have been raised by concerned readers. Generally these have boiled down to how safe or otherwise they are to have in your house, how safe they may be if your house is burned to the ground, and confusion about the correct way to dispose of them. Most of these questions seem to be answered in a report I've been sent from the Fire Protection Association Australia.

Back in the March 1996 issue, you may recall, Victorian reader Alan Elliott asked for an explanation of how ionisation-type smoke detectors work. (These are the type sold widely for less than $20, for use in domestic situations.) He was concerned that they appeared to contain radioactive material, and might therefore pose a radiation hazard. Then in the September 1996 issue we published a letter from Queenland reader Frank Moran, raising a related question of the confusion that seemed to exist regarding the correct disposal of these detectors.

We couldn't provide much in the way of solid information at the time, but later on I found a brief explanation in *New Scientist*, and reproduced it in the April 1997 column along with some comments from the magazine's UK readers, and also a letter from our own reader Felix Scerri of Ingham in Queensland. Mr Scerri echoed the fears of Mr Elliott, and added one of his own: what were the dangers of radioactive material being released into the atmosphere, if the detectors themselves were destroyed in a fire?

Soon after the April issue was published, I received a call from Mr Troy Williams, policy support manager for the Fire Protection Association Australia (FPAA). Mr Williams said that under its former name the Fire Protection Industry Assocation of Australia (FPIAA), his organisation had done quite a comprehensive study of ionisation-type smoke detectors, with particular reference to their disposal. He explained that they'd produced an Interim Position Paper, giving quite a bit of information on these detectors — would I like to see a copy?

Needless to say I accepted his kind offer, and not long afterwards a copy of the paper arrived. It's taken me a while to get around to reading it in any depth, but now I've had the opportunity to do so, I thought I'd share with you some of the interesting information it provides. So here goes...

By the way, the paper is called *A National Perspective on the Disposal of Ionisation Type Smoke Detectors (Interim Position Paper)*, and it's dated September 1996. Further information would presumably be available from the FPAA at PO Box 456, Camberwell Vic 3124.

First of all, here's the paper's introductory section describing the ionisation-type smoke detector, how it operates and how the radioactive pellet is made:

Definition - Ionisation type smoke detector

Current technology supports several types of smoke detectors used for fire detection. This submission seeks to address the disposal of one specific detector used in many Australian homes — the ionisation type smoke detector (hereafter called domestic smoke alarm). Domestic smoke alarms are readily available through most retail stores in which home products can be purchased. Many supermarkets also sell the units.

Domestic smoke alarms of this nature have become popular throughout the world because of their low cost. As discussed later, alternative types of smoke alarms are available but at a cost at least 400% higher than domestic smoke alarms.

Alternative versions of ionisation smoke alarms are also available and this submission refers to them as commercial detectors. The term detector is used as it is common for commercial detectors not to contain a sounder. The purpose of a commercial detector is to communicate electronically, either via cable or a wire-free system, with a fire indicator panel. This panel will monitor, and control when necessary, alarm equipment and fire suppression (usually water sprinkler or gas) systems as part

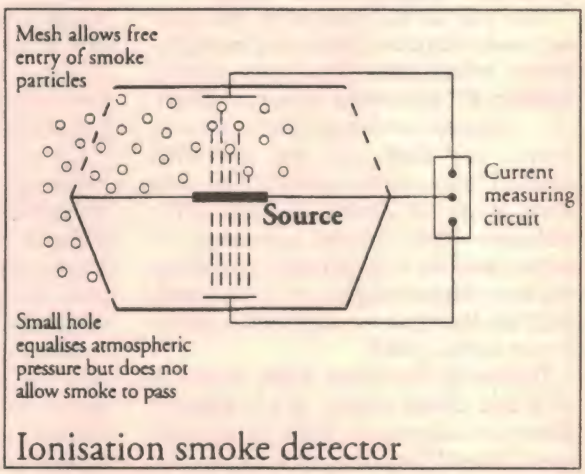


Fig.1: The diagram given in the FPAA/FPIAA paper, showing the basic construction and operation of a domestic ionisation-type smoke alarm detector. The source pellet containing Americium 241 is in the centre, and particles of smoke can only enter the chamber above it. Presumably the electronics detects the difference in ion currents between the two chambers, when smoke is present.

of a complete fire detection, alarm and suppression system. Commercial detectors typically contain an ionisation chamber and circuitry sufficient to permit the unit to be powered from and communicate with an alarm indicator panel. Commercial detectors are often installed in offices, factories, some hotels and other business occupancies.

The [domestic] units are a self-contained, containing an ionisation chamber, sounder, power source (usually a 9-volt battery) and necessary circuitry. Mains powered versions, 240-volts with a step-down transformer, are also available.

Some earlier units contained large amounts (60µCi to 100µCi+) of Americium 241 or quantities of Radium 226, and FPIAA understands the continued use of these units may be inappropriate. Some special purpose units also utilised Krypton 85. The Association's membership has worked with health authorities in some States to effect the removal of these units from various installations.

This submission seeks primarily to address issues surrounding the disposal of domestic smoke alarms with an Americium 241 content of less than 1µCi.

Ionisation Chamber Operation

Domestic smoke alarms contain a small quantity of radioactive material, Americium 241. Typically, the quantity is less than or equal to 1µCi (approx =37kBq) of Americium241. This material emits low level gamma rays and alpha particles, the latter of which produce ions after colliding with air. The metal chamber in which the Americium 241 is placed has a low level voltage applied to it. This energises the chamber, allowing the chamber to collect the ions. This causes a steady current flow that is monitored by the unit's circuitry.

The entrance of smoke-filled air (or other aerosols) alters the incidence of ionisation and as a consequence, the electric current level. The domestic smoke alarm's internal circuitry detects the change in current flow and subsequently activates the alarm. (Editor: See Fig.1, reproduced from the paper. The detector system appears to be of the differential type.)

The design of smoke alarms is often such that whilst the ionisation chamber may be accessible, the Americium 241 source is most certainly not. The source is contained inside two wafers, one of gold and the other silver. A good description of the way the Americium 241 is assembled follows:

The majority of Ionisation Chamber Smoke Detectors (ICSD) utilise the oxide form of the alpha-emitting radionuclide 241Am ($241AmO_2$). Americium oxide is uniformly mixed with gold, formed into a briquette and sintered at above 800°C. The briquette is then mounted between a backing of silver and a front cover of gold or gold/palladium alloy and sealed by hot forging. The composite material thus formed is cold rolled to give the desired activity loading, which ranges from 0.01 to 2.5µCi/mm. An additional corrosion resistant material, either rhodium or gold, is commonly electroplated on the top surface. Total foil activity ranged from 0.5 to 130µCi in the past with modern designs utilising 1 to 2µCi 241Am. The sources are commonly fixed onto metallic holders, usually stainless steel or plated brass, by soldering or crimping them to the holder wall.

Domestic & Risk/Benefit implications of Am-241 in Smoke Detectors Disposed of in Normal Wastes. [Extract] Proceedings of Health Physics Society Twelfth Midyear Topical Symposium, 1979, Virginia, USA.

The method of bonding the gold and silver to the Americium 241 is such that the source is virtually inseparable from the wafer. Indeed, the wafer itself is

inseparable from the unit's printed circuit board without a deliberate effort or destruction of some nature.

As you can see, this suggests that (a) there's only a very tiny quantity of the active Americium 241 material in a detector's sensor, and (b) that it's pretty securely 'locked' into the gold and silver foil, making the risk of it leaching out seem fairly low. But let's stick with the paper, because it goes on to discuss the various health concerns:

What are the Health Concerns?

It has been suggested, without substantive evidence, that it may be unsafe to dispose of domestic smoke alarms via the municipal garbage collection. Disposal may be via land fill placement or garbage incineration. FPIAA finds this proposition difficult to sustain when viewed in concert with the advice from laboratories and some Governments. Much of this advice is contained in research papers that are cited in this report. Indeed, all the evidence that has been made available to FPIAA suggests that the reverse is the case.

FPIAA believes within the context of available evidence, it is safe to dispose of domestic smoke alarms in land fill or via garbage incineration. There are no significant environmental or health risks associated with radiation pollution.

FPIAA has raised the issue with many foreign governments to establish what is their policy and the scientific rationale for it. Although not all of the countries have been able to respond before the finalisation of this interim report, there has been no suggestion a single case of sickness, including cancer, has been associated with the use or disposal of domestic smoke alarms.

Radiation Emission

The radioactive material in domestic smoke alarms, Americium 241, is a fabricated material. It emits both gamma rays and alpha particles and has a half life of approximately four hundred years.

The document AS3786-1993, Self-contained Smoke Alarms issued by the Standards Association of Australia requires that each domestic smoke alarm contain less than 37kBq (about 1μCi) of Americium 241. This is equal to thirty-seven thousand nuclear disintegrations per second and is not an excessive nor dangerous measure.

The fabrication of most domestic smoke alarms is such that the unit's constituent materials absorb the emitted alpha particles. The gamma rays escape in small quantities.

External Exposure

Although this report seeks to address the issue of disposal policy, there are advantages in examining direct human exposure to Americium 241 through use of domestic smoke alarms in family homes. This assists the comprehension of the diminutive risk associated with the units. The British-based National Radiological Protection Board (NRPB) has examined the radiation exposure levels to humans when domestic smoke alarms are installed in homes. The NRPB reported:

During normal use of ICDS [Ionisation Chamber Smoke Detectors] the doses to members of the public are limited to those resulting from external radiation. The dose equivalent rate in air, D, at a distance d (m) from the surface of an ICSD, is given by:

$D = (\tau \times A)/d^2$

where τ is the dose equivalent rate given in terms of Sv/h at 1m from 1GBq and A is the activity of the source in GBq. The value of τ for americium-241 is 2.4 x 10^{-6}.

Documents of the NRPB, Volume 3, Number 2, 1992. National Radiological Protection Board (UK)

The Australian design document for domestic smoke alarms, AS3786 - 1993: Self Contained Smoke Alarms, states that the activity of Americium 241 should not exceed 37kBq. If we allow for inaccuracies and allow for 40kBq, it can be determined that the dose rate at two metres from the domestic smoke alarm will be no more than 24pSv/h. The NRBP (UK) also recognised:

Most ICDS will be installed on staircases or in hallways and an individual will spend very little time in these areas. Some, however, may be installed in bedrooms. In estimating the doses, the following assumptions have been made.

(i) The ICDS is installed in a bedroom, irradiating the individual for 8h each day.

(ii) The body to source distance is 2m.

The maximum effective dose equivalent to the individual is therefore 70nSv each year.

Documents of the NRPB, Volume 3, Number 2, 1992. National Radiological Protection Board (UK)

At a distance of one metre, exposure to 37kBq of Americium 241 is approximately 0.13 nanosievert per hour. This equates to 0.0011 millisievert per year. To place this into perspective, this degree of exposure constitutes a dose of less than one-thousandth of the average background radiation measure.

Given that most domestic smoke alarms are installed on the ceiling, the distance between humans and the source of the gamma rays will exceed one metre. Radiation exposure is therefore limited and not necessarily hazardous. The Australian Radiation Laboratory has published a paper that supports this view. This paper states:

The gamma ray dose rate from approximately 37 kilobecquerels of americium 241 is approximately 0.13 nanosievert per hour (or 0.0011 millisievert per year) at a distance of 1 metre. Continuous exposure at this distance gives a dose rate of less than one-thousandth the average background radiation dose, which is about 2 millisievert per year. The variation of dose rate with distance obeys the inverse square law where, for example, at twice the distance, the dose rate is one quarter. As smoke detectors are usually mounted on the ceiling, the average exposure distance will be greater than 1 metre. At such distances, the dose rate is much smaller than that mentioned above.

Information Sheet - Radioactivity in Domestic Smoke Alarms. Australian Radiation Laboratory - June 1994

The exposure to humans, plant and wildlife will be even less when the domestic smoke alarm is placed in land fill or an alternative disposal location.

As noted by the Australian Radiation Laboratory, the degree of exposure

observes the inverse square law, where at twice the distance, the exposure is equal to one quarter the original amount. It can therefore be reasonably assumed, in the context of this and other available information, that at a distance of 10 metres, dangers to exposure from emitted gamma rays are virtually non-existent.

If there is little or no risk associated with direct exposure to Americium 241, it is reasonable to presume that the environmental or health [risks] are almost non-exist when spent units are disposed of in land fill.

Watertable Pollution

There has been some speculation as to how disposal in land fill will affect watertables or waterways. The Americium 241 is packaged in a manner that the material is insoluble and leach rates are negligible. This is supported in a 1995 research paper that stated:

A smoke detector disposed of in a municipal tip could leach radioactivity to a local water course. Immersion tests [7] have indicated very slow leach rates. The movement of Am241, once leached from the source, has been estimated [5] to be 10^{-4} of the ground water velocity. Public radiation doses due to leaching would be negligible.

[5] Recommendations for ionisation Chamber Smoke Detectors In Implementation of Radiation Protection Standards, OEDC NEA, 1977.

[7] A summary of an integrity Testing Programme on Alpha Foils used in Ionisation Chamber Smoke Detectors, TCR Report No. 378, 1975.

Domestic Smoke Detectors - A Radioactive Waste Problem?, M W Cater, Radiation Safety Consultants. Paper to the 9th International Congress of the International Radiation Protection Association, Vienna, April 1995.

This would suggest that although leaching may occur, the levels of contamination do not represent an environmental risk. For a health risk to exist, it would require contact with a concentrated volume of the leachate and this is unlikely given the substance's dilution in its surrounds.

Atmospheric Distribution

The only possible manner for Americium 241 to be distributed in the atmosphere is with the incineration of the domestic smoke alarm. This is possible through two avenues, either municipal incineration of garbage or the unit's destruction in a fire (presumably house fire, etc).

It is important to remember that there are very few garbage incinerators in Australia and of those that are in operation, the long-term viability of their operation is a matter for speculation. A British study established that disposal of municipal garbage via incineration represents a minimal risk of exposure:

ICSDs may be disposed of with normal household waste. In practice, this means that some may be sent to a landfill site and may be incinerated. In estimating the potential effective doses from disposal the following assumptions have been made.

(i) There are 20 million homes in UK.

(ii) Each household in the UK has one ICSD.

(iii) 20% of these ICSDs are disposed of each year.

(iv) of those disposed of are distributed between 500 landfill sites, ie a maximum of 6400 ICSDs per site each year.

(v) 20% of those disposed of are distributed between 200 incinerators, ie a maximum of 4000 ICSDs per incinerator each year.

***Disposal to a landfill site**: The two main pathways for exposture associated with this method of disposal are ingestion of drinking water contaminated with leachate from the site, and inhalation of airborne contamination caused by a waste fire. Appendix C states that an ICSD which passes the test for the effects of fire will release no more than 200Bq during a fire. In estimating the doses arising from a waste fire, the following assumptions have been made.*

(i) 1% of the ICSDs disposed of at a single landfill site are involved in waste fires during the year.

(ii) 200Bq are released from each ICSD involved in a fire.

(iii) Each fire is of short duration. This is taken to be 30min.

(iv) The most exposed individual lives 200m from the tip.

(v) The ground-level time integrated concentration for unit release (1Bq) in normal weather conditions (Pasquill category D) at 200m from the tip is 25 x 10^{-4}Bq.s.m^{-3}.

(vi) The breathing rate of an adult is 3.33 x 10^{-4}m^3/s.

(vii) The committed effective dose equivalent per unit intake to an adult via inhalation is 1.2 x 10^{-4}Sv/Bq.

The maximum committed effective dose equivalent to an adult from one year's intake is therefore 130nSv.

The committed effective dose equivalent to an adult drinking contaminated water during one year was estimated in NRPB-R205 as 1.2nSv from a shallow inland burial of 1TBq. If 6400 detectors of the maximum activity allowed by the Standards are disposed of, the total activity disposed of at a single landfill

per year would be 260MBq. This would give a maximum committed effective dose equivalent to an adult of 0.3pSv from one year's intake.

***Disposal via incineration**: Appendix C states that an ICSD which passes the incineration test will release no more than 1% of its activity during incineration. In estimating the doses arising from incineration, the following assumptions have been made.*

(i) 1% of the ICSD activity is released during incineration.

(ii) The release is constant throughout the year.

(iii) The stack height is 50m.

(iv) The maximum ground level time integrated concentration for unit release (1Bq) in normal weather conditions (Pasquil category D) is 3 x 10Bq.s.m.

The potential doses arising from normal use, accidents, misuse and disposal of ICSDs which comply with these Standards do not exceed the appropriate dose criteria.

Documents of the NRPB, Volume 3, Number 2, 1992. National Radiological Protection Board (UK)

The research obtained by FPIAA on this matter suggests that the amount of Americium241 released into the atmosphere from incineration of the smoke alarm is minuscule and does not represent a danger.

As previously stated, the Americium 241 is contained within a foil of silver and gold. Therefore, before the Americium 241 could be inhaled, the gold and silver foil would first need to be destroyed. In a public information sheet, the Australian Radiation Laboratory observed that:

Silver melts at 960°C and vaporises at 1950°C. The highest temperature in a house fire is unlikely to exceed 1200°C. The radioactive material almost certainly would not become available for inhalation, even if anyone would be present in that environment to breathe it in.

Information Sheet - Radioactivity in Domestic Smoke Alarms Australian Radiation Laboratory - June 1994

This would suggest inhalation should not be a serious health risk. This view of the Australian Radiation Laboratory is supported by an article published in the New Zealand Radiation Protection News & Notes (July 1990) that stated:

The sources have been subjected to high temperatures in accidental fires and prescribed fire (600°C) and incineration (1200°C) performance tests. These have shown that in extremely hot fires which melt the devices and incinerate all combustible material, the sources generally remain as discrete lumps and only a very small fraction of the activity becomes airborne in the respirable range. Of the rubble left over after a hot fire, less than 1% of the activity is in the respirable range. Analyses of maximum likely inhaled activities indicate that both in the case of firemen who might attend fires which engulf smoke detectors, and in the case of persons involved in clearing-up operations, the inhaled activities would be unlikely to exceed a very small fraction of an annual limit of intake (ALI), which is the limiting annual intake for an occupationally exposed person recommended by the International Commission on Radiological Protection.

Radiation Protection News & Notes, No 11, July 1990 NZ National Radiation Laboratory.

Hmmm — so there you are, more or less. But in case you've become a bit confused by all of those nanosieverts and kilobecquerels, here's the paper's Executive Summary section. It seems to summarise the FPAA's position on ionisation type smoke alarms fairly well:

EXECUTIVE SUMMARY

The Fire Protection Industry Association of Australia (FPIAA), as Australia's peak fire industry body, has examined the disposal of ionisation type smoke alarms. The aim of this research has been to arrive at a sensible and scientifically sound disposal options.

FPIAA's work in this area has been carried out over many years. Interest by non-industry parties gained momentum with the work of the Senate Select Committee on the Dangers of Radioactive Waste. This committee has since reported.

The most surprising aspect to the entire issue is that FPIAA has been unable to locate any evidence that suggests that domestic smoke alarms containing less that 1μCi of Americium 241 are a notable environmental or health risk. Further, FPIAA understands:

- *The possibility of contamination to the environment is negligible as the emissions from the source are small and the source is insoluble; and*
- *Human consumption of the source, either by ingestion or inhalation, is not only unlikely but does not constitute a health risk.*

By the nature of use and distribution, regulatory controls on the disposal of domestic smoke alarms are difficult to police. The community will simply dispose of spent units in the garbage. On scientific grounds, there is no basis to do otherwise for individual detectors. FPIAA therefore recommends:

- *That the community be allowed to dispose of spent smoke alarms in their municipal garbage collection;*
- *Where the work of industry facilitates the collection of many detectors, these be returned to the supplier or placed in a national radioactive substances repository; and*
- *That FPIAA work with Government in assisting the community to understand the disposal policy.*

The current policy and regulatory framework of the Western Australian Government is consistent with FPIAA's proposals. The Association commends this policy's principles as a sound model for adoption by other states.

As you can see, the FPAA/PPIAA is even suggesting that the detectors can be disposed of in the usual ways — which is probably just as well, because from what I've heard it seems that in most areas of Australia there are really no other practical alternatives anyway. I trust you're suitably reassured. ❖

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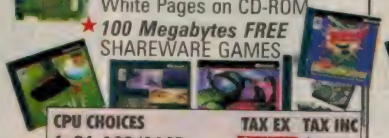

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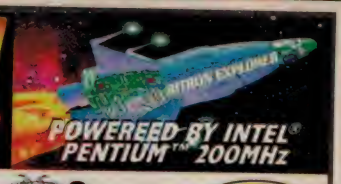

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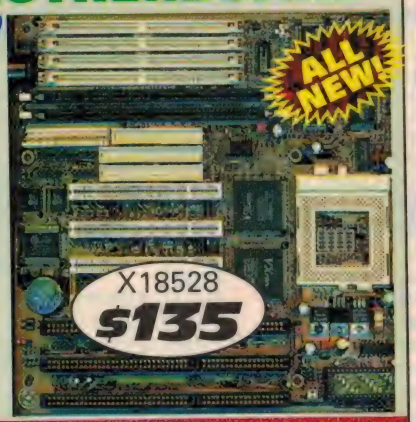

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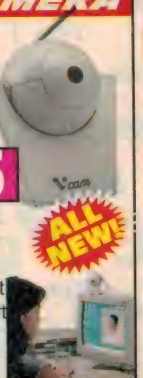

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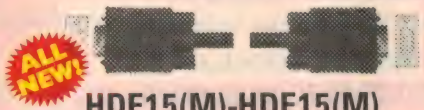

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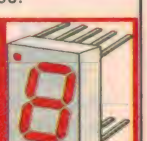

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K10845 $64.95

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This little project take advantage of the White LED's bright white light, its high efficiency and fast response time. The Ministrobe can effectively "stop the motion" of almost anything running from 400 to 4000rpm, such as electric motors, car engines, electric mixer. ***EA Aug '97***

K10870 $24.45

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This compact unit produces both square and triangle waves over the frequency range from 100Hz to 20KHz. Build it and use it to test audio amplifiers, filters, tone decoders and digital circuits. ***SC Jul '97***

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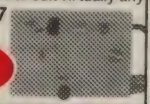
K10830 $8.45



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K10860 $8.45

MANUAL CONTROL CIRCUIT FOR A STEPPER MOTOR

This ciruit will give you manual control of a stepper motor in one direction or the other. It will have a variety of applications and a demonstration is included to show how it could be used to control a model railway boom gate. Motor is not included. ***SC JUN'97***

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K10875 $71.95

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This interface card allows you to drive a stepper motor using software control. It plugs into your PC's parallel port and you can connect up to eight units in daisy-chain fashion. ***SC Aug'97***

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AUDIO FREQUENCY SHIFTER

Here's a new low cost design for a unit which can be of great assistance in controlling feedback ("howl-round") in public address and other sound reinforcement systems. It operates by shifting the audio spectrum by 5Hz, and features a very low noise and distortion over a full 20Hz to 20kHz bandwidth. ***EA Aug '97***

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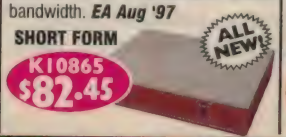
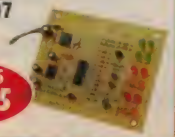


TRAFFIC LIGHTS FOR AN INTERSECTION

Most model railway layouts have a few roads winding their way around and often a small town with an intersection is included. A good way to add life to such a scene is to have working traffic lights at the intersection. ***SC MAY'97***

K10835 $18.95



POINT CONTROLLER FOR MODEL RAILWAY

Most model railway enthusiasts operate their points with a twin solenoid connected to a 15V supply. However, if you keep your finger too long on the button for just a moment too long, you can easily burnt out the solenoid coil. This point controller avoids that problem. ***SC Jul '97***

K10850 $11.75

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THE MILLENNIUM BUG: WILL WE ALL SURVIVE?

Is the so-called 'millenium bug' a real computing problem, or just a media beat-up? We look here at where the problem lies, for those with an IBM-compatible PC, and where you can find solutions.

by DARREN YATES

There wouldn't be a human alive (at least in countries like Australia) who hasn't copped a gob-full on the Millennium Bug. Some sections of the media have certainly had a field-day, beating their drums and telling everyone "Hey! The world as we know it is going to end..."

But when the smoke clears and the mirrors are put away, is there a *real* problem looming at the end of this century, for those of us with an IBM-clone PC? Potentially, you'd have to say yes. But when start looking for some real answers, it's a mystery to most people. However most analysts agree that the root of the problem lies in the real time clock of the PC.

Inside most modern PCs there's a device called a Real Time Clock, like the one indicated here. Located near the microprocessor and BIOS chip, it's where the PC keeps track of the date and time.

Real Time Clock

The way a PC keeps time is by using what's known as a Real Time Clock, a battery-backed chip to keep track of the time in a CMOS memory. However, when the RTC was originally designed, way back when Noah was a young lad, memory was expensive and like a spring-time cleanup, it was a case of everything that didn't move was thrown out in order to save money. It was deemed too expensive to carry two digits that didn't change — so when the date was stored by the RTC it was in the form YY/MM/DD. So the date '16th June 1997' appears in the memory as '970616' rather than '19970616'.

The original designers didn't think we'd still be using their system by now, but unfortunately the 'legacy' mindset has meant that new technology has just been designed around it rather than dropping it altogether.

The Bug

All programs effectively take their timing from this RTC, whether directly or indirectly. And since the RTC only provides the two least significant year digits, the applications software generally assumes that the other two digits are '19'.

The problem is, therefore, that when we clock over into another century, most applications will think it's 1900, not 2000. So if you were born in 1952, you'll be -52 years in the year 2000. Basically, anywhere the date is stored or calculated, this is a potential problem whether it be hardware or software, including database and spreadsheet files.

The more accurate name for the bug is the 'Century Bug', because as you can see, it really has nothing to do with the start of the new millennium — just the start of a new century.

Motherboard manufacturers are already making changes to their BIOS to try and fix the problem, but as these modified BIOSes are only appearing in the most recent motherboards, there are still plenty of PCs for which the year 2000 may pose a serious problem.

Remedies

For a good portion of PCs, the fix could be as simple as manually changing the date — once — on January 1, 2000.

Fixing the century byte problem in real time is still something no one has really come to grips with.

While the RTC keeps the date as a two-digit year system, DOS keeps the date in terms of days after January 1, 1980 and converts it to a four-digit year date when an application asks for it — but unfortunately this doesn't really solve the problem either. The DOS clock only works while DOS is operating, i.e. while your PC is on. It's the RTC's job to keep time when it's off.

When you boot the PC up again, the RTC will go from 1999 to 1900. DOS will see this, spit the dummy and say it's wrong — but it will then throw up January 1, 1980 as a default.

There are reports saying that even some of the current BIOSs found in 486 and Pentium-based PCs can't be fixed without a chip upgrade.

Award BIOS

According to Award Software International, the company that's supplied about 50 million BIOS chips, if your BIOS is dated before April 26, 1994, all you need do is to boot up once, reset the date to 2000 and you'll be right. If you're one of the unlucky ones with a BIOS date of between April 26, 1994 and May 31, 1995, then you'll need a BIOS upgrade. If you're lucky to get one after May 31, 1995, the BIOS automatically toggles around from 1999 to 2000.

Phoenix BIOS

Phoenix Technologies Ltd say they fixed the problem with their BIOS chips in February 1995. According to Phoenix, all you need to do to check your own PC is set the date and time to 11:57pm on 31/12/1999, turn your PC

off for five minutes, then boot up with a DOS floppy disk with no CONFIG.SYS or AUTOEXEC.BAT. If the date shows the year 2000, you don't have anything to worry about; otherwise you'll need a BIOS upgrade.

However, Phoenix doesn't sell direct to the public and their standpoint is you should go back to the PC vendor...

Help via the Web

As usual, there are plenty of shonks out there to easily part the well-meaning fool with his money. But a quick look on the Web reveals some freebies that will get you on the right track. These sites will help you find out how much your PC hardware and software will be affected by the problem.

If you're planning to use any of them for personal use only, most of it is free but be warned — there are no warranties here.

Hardware fixes

First of all, let's look at 'hardware level' fixes. The first of these is a little assembly code routine which checks the RTC to see if says '1900'. If it does, it changes it to '2000'; otherwise it leaves it as it is. It's pretty simple and it seems to take care of the hardware side of things.

You can download this freebie from **www.wsnet.com/~designer/holmesfx**. The site contains all of the assembler code as well as the HOLMESFX.COM file, which you simply load in your AUTOEXEC.BAT file.

The important thing to remember is that this will only work when you boot your PC up after midnight, January 1, 2000. As the author admits, you won't be able to use it on server-based equipment that runs continuously. However, it does take care of the solution suggested by Award Software International.

The second source is **www.rightime.com** which contains a number of small utilities to check your PC's date capabilities. One of the handier ones is VIEWCMOS.ZIP which allows you to dynamically see what your RTC CMOS memory looks like. Plus there's YEAR2000.COM, another applet claiming to fix the problem. From what I can gather, it's similar to HOLMESFX.COM.

Where to get info on the Web

Further information on Millenium/Century bug problems regarding PCs is available from the Web at these sites:

Award BIOS: www.award.com
Phoenix BIOS: www.ptld.com
AMI BIOS: www.megatrends.com
Year 2000 web site: www.year2000.com

Software checker

The final applet is the Year 2000+ Software Analyser. This applet runs under either Windows 95 or Windows 3.1 and checks lines of source code for potential problems. It won't fix them, it just finds them for you. Again, this is a free tool available from **www.bozeman-legg.com/Y2KANALYSER.HTML**. The SETUP.EXE file is 1.8MB and automatically installs. It doesn't check databases for date problems but as an initial step, it's well worth a look.

With all of these solutions, particularly the shareware downloads, it's at your own risk. There are no warranties here, so only try these files if you're capable of restoring your system. Of course this will probably be as likely as pigs in flight, but it must be said anyway.

For most of us, the year 2000 should be a time of celebration rather than complete chaos.

(Darren Yates is Technical Editor of the Sydney Morning Herald's 'Icon' Computer Section, and a regular contributor to Electronics Australia) ❖

Circuit & Design Ideas

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

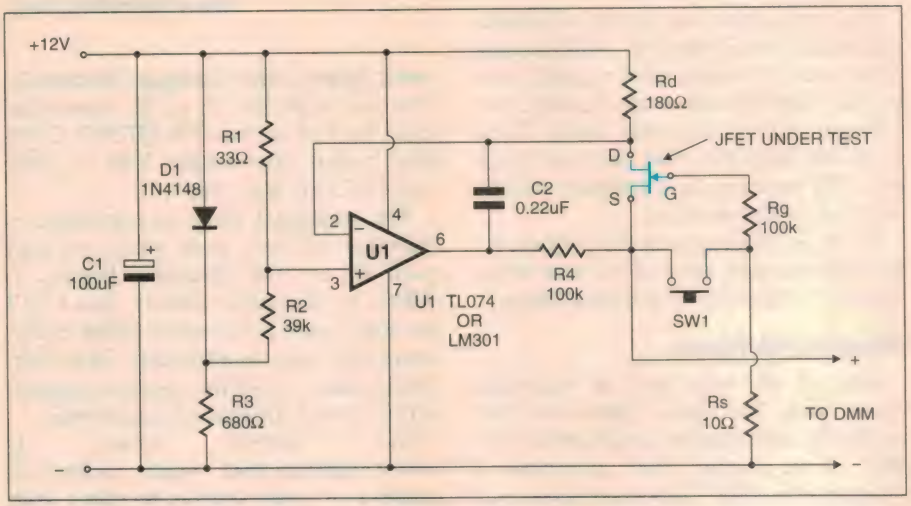
JFET test adapter for DMMs

Many amateurs avoid using JFETs even though many circuits would benefit from using one. JFETs offer a very high input impedance, high bandwidth and low noise. It is, however, harder to design a JFET circuit because JFETs even from the same batch will have widely varying pinch-off voltage (Vp) and drain saturation current (Idss).

These parameters are paramount in establishing proper DC biasing, and so I've devised this circuit that will quickly find these parameters for N-channel JFETs. (Chances are that you will never in your life see a P-channel one.) This will let you approximate forward conductance (Yfs), and of course match devices for, say, a differential long-tailed amplifier stage.

With SW1 open, the circuit works as a current regulator. The voltage drop across Rd (caused by the drain current flow) is compared with the reference voltage from D1 divided by the resistive divider R1 and R2.

These two voltages are compared by an op-amp (who's input range must include the positive rail, like an LM301 or a TL071), which then adjusts the JFET's source voltage accordingly. C2 stops the op-amp from oscillating. For the values shown, the current is around 2.5uA, and the voltage between source and negative is the device's pinch-off voltage.



With SW1 closed, the JFET's gate and source are at equal potential and the voltage drop across Rs numerically equals the drain saturation current times ten.

Don't omit resistors R4 or Rg, as these limit the current flow through the gate-channel of an incorrectly inserted JFET. Note that interchanging the drain and source isn't damaging, and in most cases the FET will function normally.

The tester runs from a 12V plugpack to give sufficient drain-source voltage, but I did some tests with supplies of 12V, 9V and 6V and a 2N5486 FET. As the supply fell from 12V down to 6V, the FET's pinch-off reading dropped from 3.19 to 3.16 (insignificant), and the drain saturation current fell from 9.7 to 9.3mA (a 4% drop) which is acceptable.

Battery operation does have one serious disadvantage, in that a FET's Idss should ideally be measured with the drain-source voltage at least equal to its pinch-off voltage.

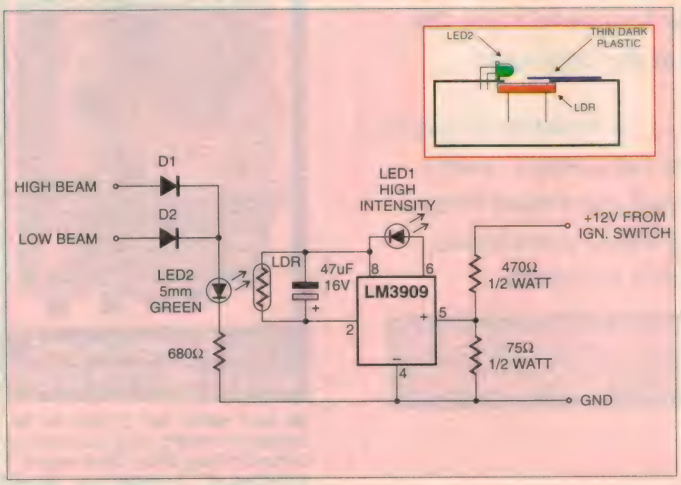
Marcin Frankowski
Warszawa, Poland **$40**

THIS MONTH'S WINNER!

Headlights off indicator

Devices to remind you that you have forgotten to switch your headlights off are readily available, however I have never seen or heard of one that would remind you to switch them *on*; that's why I devised this circuit.

The entire circuit will fit into the smallest plastic box available, and the high intensity LED can be easily mounted on the dash of your vehicle either as a heads-up display (reflecting off the windshield), or mounted on the instrument panel.



The light dependent resistor is exposed to the ambient light by mounting it outside the box, or by allowing light to fall on it through a hole drilled in the case.

As daylight begins to fade and you decide that it would be a suitable time for the headlights to be switched on, slide a piece of thin, dark plastic over the LDR, until the LED just starts flashing (it should only be about half covered). You can then glue this to the case, or use a piece of insulation tape instead.

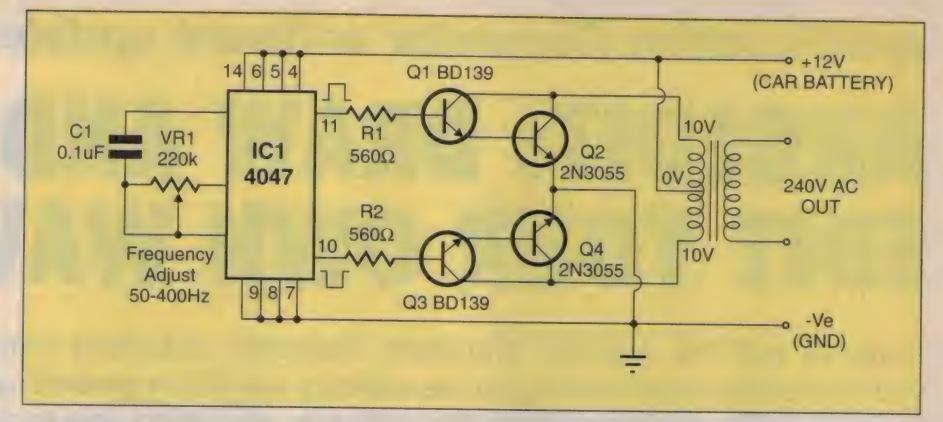
From now on, whenever dusk falls, the LED will flash reminding you to turn on your lights. When you do switch them on, LED2 shines onto the LDR and stops LED1 from flashing.

Kelvin England
Wendouree, Vic. **$30**

Inexpensive power converter

This circuit uses cheap and easy to find components, and can produce 240V AC to drive low power loads such as fluorescent lights or an electric blanket during camping trips. IC1 is a 4047 astable multivibrator, and its frequency can be set over the range of 50 to 400Hz by adjusting VR1.

The symmetrical square waves produced on its Q and Q-bar outputs are 180 degrees out of phase and drive the buffer transistors Q1 and Q3. These transistors in turn switch the high power switching transistors Q2 and Q4, which alternately short one end of the output transformer or the other to the negative supply rail. The center tap is connected to positive, and so an alternating voltage is applied to the transformer.



The transformer is a 240V primary, to centre tapped 20V (10V-0-10V) secondary 3A power transformer used here in reverse. It is advisable to properly heatsink the output transistors as they may overheat in operation.

While the output voltage of this inverter isn't regulated, it should serve in non-critical applications.

Pradeep G.

Alappuzha, South India **$25**

Simpler sampler

Here's a simple circuit for a computer-driven data logger that is simpler than the Pocket Sampler (August 1996 issue), and it costs less as well! In this version, the computer acts as part of the ADC, and so less hardware is needed.

The circuit is self-powered, and draws current from the eight data lines on the parallel port. The network of 30k and 15k resistors converts the digital value on the port into a voltage that is applied to the negative input of the comparator. By stepping through the values of 1 to 255 on the parallel port, the changing voltage (V2) is compared with the voltage to be sampled (V1).

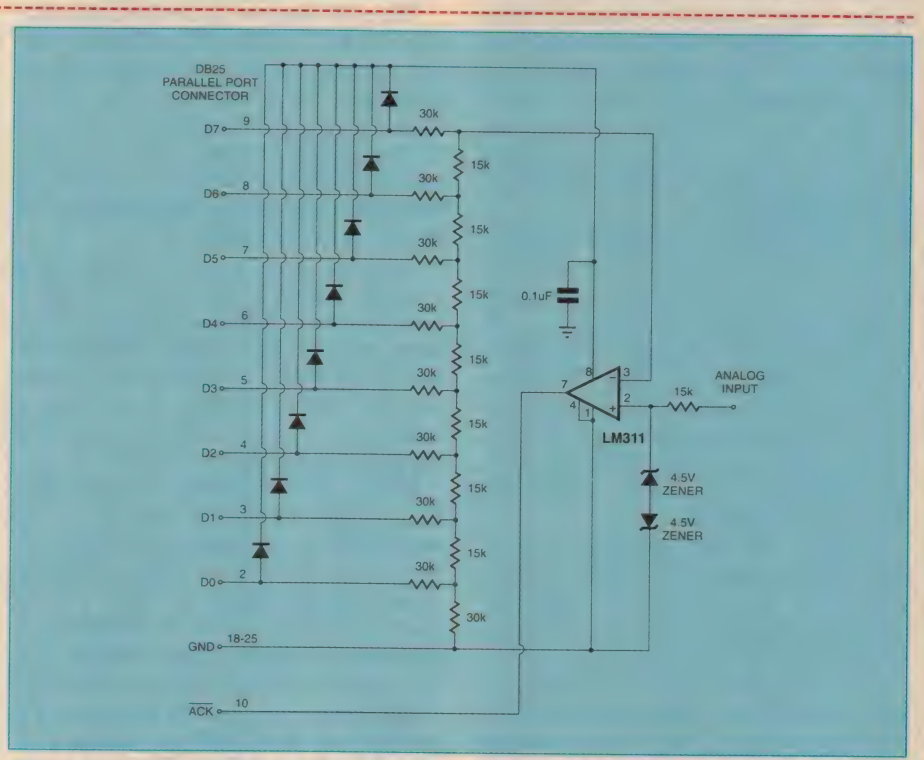
If V1 is greater than V2, then the software will count up, and if V1 is less then the software will count down to match it. The permitted values for the conversion are 1 to 255, as at least one output needs to be on to supply the comparator.

A simple program (in QBASIC) to drive the sampler is shown below (of course an assembly language program would run much faster).

The values of 56 and 120 are the actual values read in from the port when the output from the comparator is high and low respectively. At the moment the input range is limited from 0 to 4.5V, but can be extended if a voltage divider is applied to the analogue input.

Juan Miguel Akkad

Hillcrest, Qld. **$35**




```
CLS
DO WHILE INKEY$=""
    V=INP(889) '889 is the address of
LPT1 inputs
    VP=((V>56)*-1)+((V<120)*1)
    R=R+VP 'R is a raw value
    LOCATE 1,1
    PRINT R 'R goes from 1 to 255
    IF R <=0 THEN R=1
    IF R>255 THEN R=255
    OUT 888,R '888 is the address of
LPT1 outputs
LOOP
```

WIN OUR 'IDEA OF THE MONTH' PRIZE!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a compact CCD video camera module from sponsor **Allthings Sales & Services**, offering 460 TV lines of horizontal resolution and 0.05 lux sensitivity, and valued at $199.00!

Arb/Function Generator software update:

ARBEDIT: DRAW AND EDIT YOUR OWN WAVEFORMS

If you've built the Arbitrary Waveform Generator described around the beginning of this year, you've probably been waiting for the arbitrary waveform generating software to go with it. Well, the Beast is finally completed! With this software, you will be able to design your own completely arbitrary waveforms, and save them in a format compatible with Jim Rowe's ARBGEN1 software.

by GRAHAM CATTLEY

When the Arbitrary Waveform Generator was first envisaged, we realised that a means of manually editing and designing waveforms would be needed. As I was learning the C programming language at the time, I volunteered to take on the task of writing the waveform editor in order to get some practical experience in this simple-but-complex language.

As with nearly all software projects, this task took considerably longer than expected, with the program undergoing a complete rewrite at one stage — as well as suffering a changeover to object oriented programming from the procedural approach that I had originally used. The final result is, I hope, an easy to use editor that should cover most applications for the Arbitrary Waveform Generator.

Probably the best place to start in describing Arbedit, is with the screenshot below. This shows most of the features of the program, as well as the sort of waveform that can be created with it.

The screen is divided into three main sections: the top section showing the waveform and allowing manual editing with the mouse, the centre status panel giving details of the various markers and settings, and the 30 function buttons at the bottom of the screen. Due to space limitations, I'll only briefly cover the main aspects of the program here, but a more detailed account of each of Arbedit's functions will be supplied in the README file accompanying the program.

Edit window

The top half of the screen comprises the edit window, which displays a representation of the current waveform. This waveform can be edited with the mouse, just as with a painting program. Simply press the left mouse button and drag the mouse over the window, and the wave will follow the pointer.

The edit window is divided into sections by two horizontal and three vertical markers. These are used both as guidelines when drawing your waveform, and for defining the range of most of the editing functions. These markers can be moved around the window by dragging their handle displayed in the border of the edit window.

The most used of these are the three vertical markers, with markers 1 and 2 used to select a specific section of waveform, and the end marker defining the end of the waveform. These three markers are used frequently in creating a waveform, so I'll cover their use and operation in a little more detail.

Firstly, it is important to realise that the overall length or period of the waveform is determined by the position of the end marker. This end marker is coloured light red, and can be moved by dragging its END handle in the bottom border of the window. The end marker defines the overall length of the wave, and thus the frequency (or period) of the final waveform produced by the Arb Gen. The area to the right of the end marker has a black background, and can be used as a scratchpad or temporary storage area — but won't be saved as part of the final waveform.

The Arbitrary Waveform Generator described in the December 96 - April 97 issues: with this software it will generate your own custom waveforms.

The remaining two vertical markers (called marker 1 and marker 2) are used to select a section of the wave to work on.

Marker 1 has a single up-arrow handle and is always to the left of marker 2, and it defines the start of the waveform selection area. Marker 2, on the other other hand, has a double up-arrow handle and is always to the right of marker 1. It defines the end of the green waveform selection area.

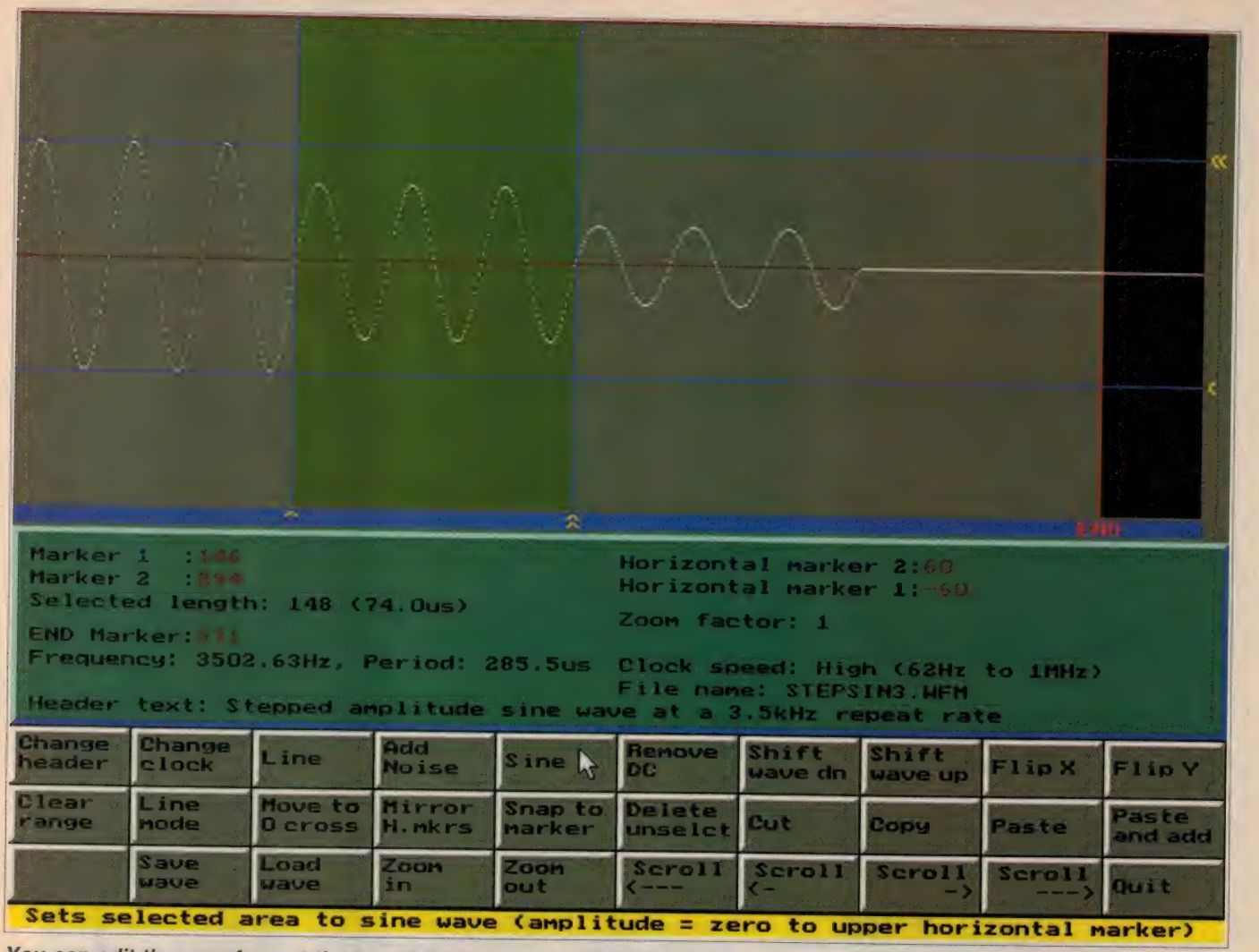
The selection area doesn't affect the wave directly, it merely defines the area in which a number of functions can be performed. These functions are selected by pressing the appropriate button, and only the highlighted section of the wave will be affected.

Waveforms of up to 32,700 bytes long can be created, and a zoom facility has been added to scale the wave into the 625 pixels available in the edit window. You can zoom all the way out to see the whole of a large wave, or zoom in to edit each sample byte individually. Note that only the X-axis is scaled, and that the Y-axis remains 254 pixels high throughout.

Status panel

In the middle of the screen is the status panel, which displays the position of each marker, as well as information on the waveform itself. Details such as the frequency and period of the final waveform, and period of the selected area are updated every time a marker is moved; while the other details, including file name and header text, can be changed with the appropriate button.

While the values of the vertical markers are always given as an absolute distance from zero (i.e., the start of the waveform), values for the horizontal



You can edit the waveform at the top of the screen by using the mouse, or use the buttons below to perform functions on the selected area. You can cut, copy and paste sections of waveform, and import data from other sources. When you've finished, the waveform can be saved to disk, and then loaded into and run on the Arb Gen.

markers are given as the distance from the mid line, or zero line in the center of the edit window. So while any vertical marker can have a value from 0 to 32,700, the horizontal markers cover the range of -127 through 0 to +126.

Function buttons

The bottom quarter of the screen is given over to an array of 30 function buttons, which perform a variety of tasks. These fall into three broad areas: functions, including sine, line and random noise; system settings, including clock speed, file description and saving/loading facilities; and editing functions incorporating cut, copy and paste, and even an 'undo' feature. There are many other functions, including 'paste and add' and 'Remove DC', and there really isn't room in this article to explain the function and operation of each button in detail; so I'll do this in the README file that will accompany the program.

As the wording on each of the buttons is by necessity a little terse, a help bar at the very bottom of the screen provides a more verbose description of the action of each button. This help description changes as the mouse is moved over each button, and should make the meaning of each function clear.

I think that once you start using Arbedit, you'll soon get the hang of everything, including the process of importing data in from a spreadsheet. This will let you design mathematically complex waveforms which can be converted to the Arb file format with Arbedit, and can then be loaded into the waveform generator.

Of course Arb files such as the ones converted by Jim Rowe's ARBGEN1 can also be loaded in to Arbedit, modified, and then saved back to disk; and sections of existing waveforms can even be copied, cut and pasted between files.

Arbedit will run on practically any IBM PC capable of driving a 640 x 480 VGA screen, and requires only one support file — which is included with the program.

I would hope that the current version of Arbedit (v2.1) will fill everyone's needs, but I'm sure that there will be requests from readers for extra functions and features, as well as the inevitable bug fixes. So there could at some stage be an updated version, and if so this would be announced in the notes and errata section in the magazine.

The latest version will always be available from the EA BBS ((02) 9353 0627), in the EA Project Software area (#140) as the file ARBEDIT.ZIP, or you can write in and order a copy by sending in a blank floppy disk and $5.00 for P+P. I will be including all the source code for the program (to justify my annotating the code...), so if anyone has any comments on the program's structure or can offer any improvements, I would welcome the feedback. ❖

DICK SMITH ELECTRONICS

Multimeters and accessories

Multimeters And 240V Mains Measurements

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- Mains rated
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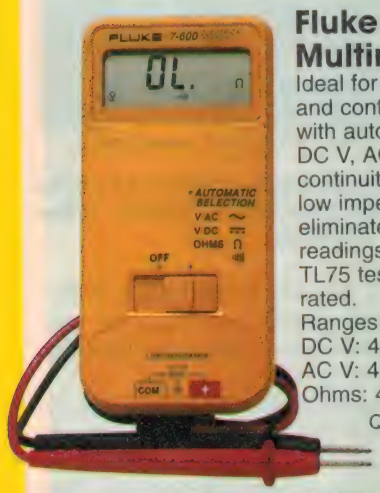
DC V: 2, 20, 200, 600V
AC V: 2, 20, 200, 600V
DC A: 200uA, 2mA, 20mA, 200mA, 10A
AC A: 200uA, 2mA, 20mA, 200mA, 10A
Resistance: 200, 2K, 20K, 200K, 2M, 20M ohm

Q 1563

$99



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AC A: 4000uA, 400mA, 10A
Resistance: 400, 4K, 40K, 400K, 4M, 40M
Conductance: 400nS
Frequency: 99.999Hz, 999.99Hz, 9.9999kHz, 99.999kHz, 250.00kHz
Capacitance: 4nF, 40nF, 400nF, 4uF, 40uF, 400uF, 4mF, 40mF

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PCB size: 19mm x 52mm.

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K 3160

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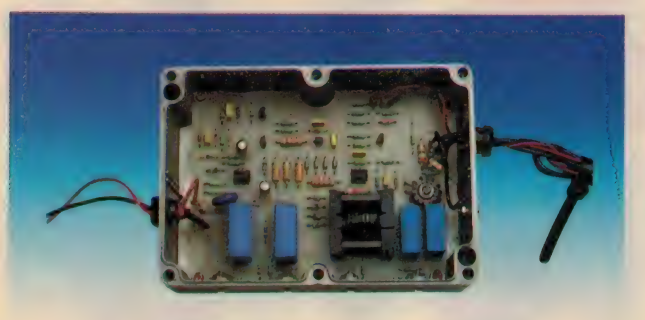

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EA Aug '97

Availability: Our kits consist of many different parts from numerous suppliers. Whilst we have consulted closely with them and are satisfied as to their ability to supply, sometimes problems can arise in obtaining all of the parts. This means there is a slight chance that availability may be delayed. Rainchecks are available, however if you'd like to check beforehand, please don't hesitate to contact your local store.

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Construction project:

IR TO UHF REMOTE CONTROL CONVERTER

This project converts any standard infrared remote control handpiece so that it transmits its signals by radio waves. A receiver converts the radio signal back to infrared to operate a VCR, TV set, or any IR remote controlled appliance. It lets you control your sound and video equipment from another room, and eliminates the need to point the handpiece at the equipment it controls.

by PETER PHILLIPS

This project has an interesting history. It started when I was asked by a local hifi dealer if I could develop a means of controlling hifi equipment from another room, without needing external wiring. The dealer showed me a commercial system, costing around $500, that had a special purpose learning remote control fitted with a small radio transmitter. The receiver was in a fairly large black box with an external antenna and contained the electronics to convert the radio signal back to the original infrared signal.

The receiver was intended to sit on a table, near the equipment being controlled, and was mains powered. It had a very complex circuit, including a microcontroller and other 'hi-tech' chips. I had already figured out a simple of way of doing all this, but seeing this commercial unit made me wonder why it was so complex, and whether I was missing something.

I went ahead and developed a prototype, and it was even exhibited at a recent hifi show. My system comprised an off-the-shelf learning remote control unit with a small UHF transmitter fitted inside. The transmitter was powered by a separate 12V battery and switched by the current taken by the IR LEDs in the remote control unit.

I built the prototype receiver and IR regenerating circuitry on strip board and fitted it into a small box that could be discreetly installed in the room with the equipment being controlled. That system has been in operation now for nearly 18 months in my home, and has become an essential part of my life. I even thought about making it a commercial product, as it excited a lot of interest.

But it's one thing to invent a device, another to market it. I had worked closely with Oatley Electronics in obtaining parts and so on, so it seemed appropriate to pass it on to them so it could be further developed as a project for hobbyists. And that's where Oatley Electronics took over.

This project converts the output of any IR remote control unit to a UHF signal. The receiver (right) converts the transmission back to an infrared signal, allowing equipment to be controlled from another room.

My system had a number of drawbacks for hobbyists, including the need for a particular remote control unit, which then had to be modified. Oatley Electronics decided to completely redesign the system, to not only make it suit all remote controls, but to incorporate more readily available parts.

The final result is a simple system with the UHF transmitter mounted externally on the IR remote control unit. The IR signal from the remote is optically coupled to the UHF transmitter, avoiding the need to modify the remote control unit. The receiver and IR regenerating circuitry is still in a small box, but has a simpler circuit than my prototype. As in my original system, the receiver is powered by a 12V DC plugpack.

The system has many advantages, and after you've used it for a while, you'll never go back to a basic IR remote control system. Perhaps the main advantage, at least for me, is that you don't need to point the handpiece at the equipment being controlled. This mightn't sound much, but if you like to lie on a lounge and listen to music or watch TV, you don't need to disturb your comfort when you use the remote control to turn up the volume or whatever.

But perhaps its main advantage is that you can control equipment from another room. There's a huge industry in hardwired remote control systems for doing just that, and a typical system can not only cost a lot of money, but it has to be installed so all the wiring is hidden.

Another significant advantage of this system is its low cost. A complete kit of parts, including a suitable plugpack is around $40. And as you'll read, it's also easy to build. It uses a ready-built UHF receiver module, and all components mount on two small printed circuit boards.

How it works

The operating principle is quite straightforward. The infrared (IR) output from the remote control handpiece is picked up by a photodiode in the transmitter. The IR output from any remote control unit is actually a series of pulses on a carrier of typically 40kHz, as shown in Fig.1. The carrier is essential to overcome the effects of other varying light sources, like fluorescent lights. This is achieved by tuning the IR receiver module in the equipment being controlled to 40kHz. This allows it to reject all other light sources, except the output from its remote control unit.

The signal picked up by the photodiode in the UHF transmitter in this project responds to the 40kHz carrier, which is then filtered out, so the resulting output is a series of pulses representing the original code. This signal switches the UHF transmitter so the code is sent as a series of pulses on a 304MHz carrier.

The receiver module has three jobs to perform: to pick up the UHF transmission, reinsert the 40kHz carrier and drive the IR LEDs to re-transmit the code as an infrared signal. This is achieved by a ready-built 304MHz receiver module, a 555 timer wired as an astable at 40kHz, and two IR diodes driven by the 555.

So why does this simple system work when a commercial unit needs a microprocessor? The answer probably lies in the value of the IR carrier frequency. While most equipment these days seems to use a 40kHz carrier, this is by no means a standard frequency. Older designs in particular sometimes use a carrier as low as 30kHz, and it's possible to have a carrier of 50kHz or more. So the commercial unit probably read the carrier frequency as well, and determined its value for subsequent re-transmission.

We've tested this project on a very wide range of equipment, including cable TV set top units, VCRs, TV sets, amplifiers, CD players and even specialised equipment (like the control box of a Pianodisc) without any problems. If you happen to have equipment that uses a different carrier frequency, all you need to do is adjust the frequency of the 555 timer in the receiver. Now let's look at the details.

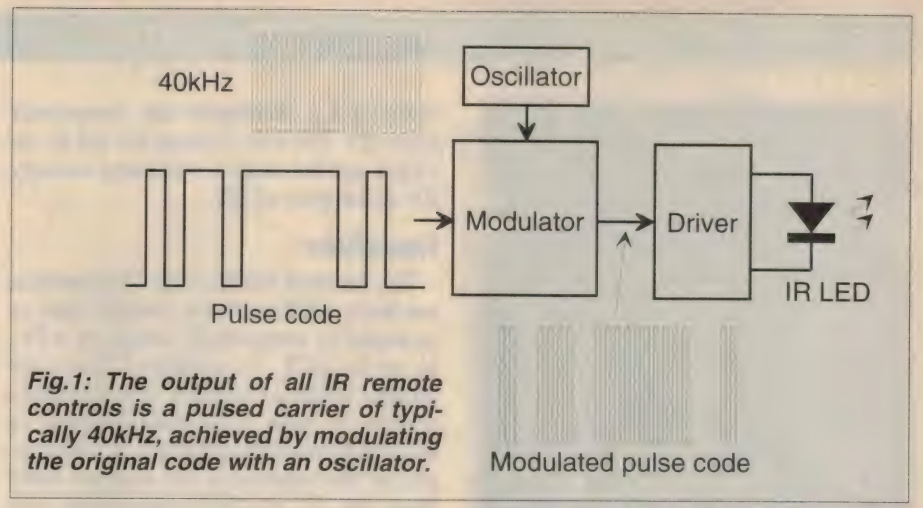


Fig.1: The output of all IR remote controls is a pulsed carrier of typically 40kHz, achieved by modulating the original code with an oscillator.

Transmitter

The transmitter is completely self-contained and is powered by a 9V battery as shown in Fig.2. The photodiode (PD1) is installed in the box housing the circuitry so it picks up the infrared signal from the IR LEDs in the remote control unit. The output of the photodiode switches Q1 at the carrier frequency of the infrared transmission and the carrier is removed by C2, leaving the original code.

When light falls on PD1, it conducts, turning on Q1 which provides current to Q3, enabling the UHF transmitter around Q2. Otherwise the transmitter is off, and the circuit consumes virtually no current.

The transmitter is tuned by VC1 and L3 (printed on the circuit board) to 304MHz. When the transmitter is operating, LED1 lights, giving a visual indication that the transmitter is pulsing in sympathy with the IR signal. Inductor L3 is also the transmitting antenna, decoupled from the supply rail by L1.

As this photo shows, the receiver case is attached to the remote control unit so that the photodiode is exposed to the IR transmission. If it's too close, the photodiode will be overloaded. As well, to prevent it responding to ambient light (and therefore enabling the transmitter and flattening the battery), shield the photodiode with black tubing or paint. Don't cover the active area of the photodiode though.

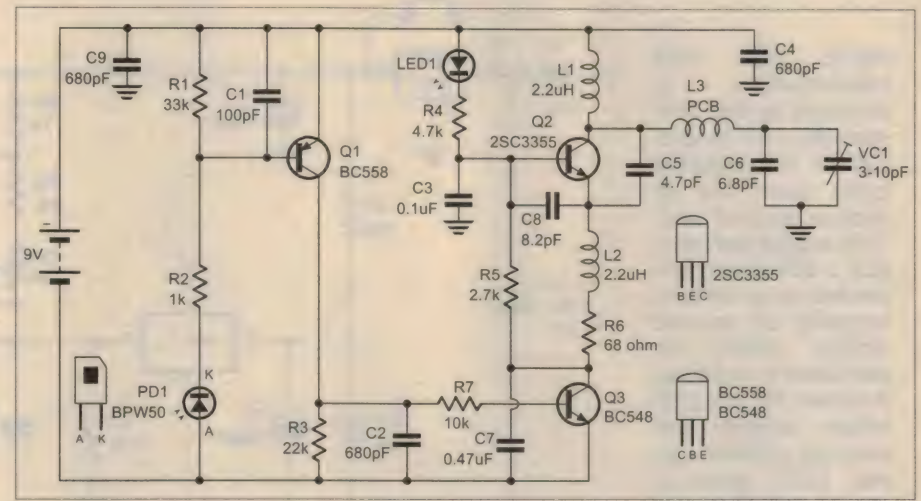


Fig.2: The output of the IR remote control is detected by PD1, and its output is amplified by Q1. The carrier signal is removed by C2 and the resulting signal switches Q3 and the UHF oscillator around Q2. The inductor L3 acts as the transmitting antenna.

Here's a close-up of the transmitter PCB. Note that some resistors are mounted vertically.

Inductor L2 decouples the transmitter from Q3. The bias current for Q2 is via LED1 and R4, with C3 filtering out any RF at the base of Q2.

Receiver

The receiver section (Fig.3) contains a pre-built UHF receiver module that is powered by a regulated voltage of 6.2V, as set by ZD1. As explained later, this module needs a couple of minor modifications to tune it to 304MHz and to allow it to directly control IC2. The output of the receiver is the original code from the IR remote control unit, but without the 40kHz carrier.

This carrier is reinserted by IC2, a 555 timer connected as a free running oscillator. The oscillator is enabled by the output of the receiver module, via pin 4 (reset input). When the output from the receiver is high (logic 1), the oscillator is enabled and runs at its preset frequency (typically 40kHz). The frequency is adjusted with VR1.

The output of IC2 drives two IR LEDs connected in series. Resistor R6 limits the peak current through the LEDs. LED1 (a red high intensity LED) gives a visual indication of the output of IC2.

Voltage regulator IC1 is only needed if the supply voltage to the circuit is higher than 15V. In most cases, you won't need the regulator or C4, so these are not supplied in the kit. Although the circuit will work with a supply voltage as low as 9V, best performance is achieved with 12V. Diode D1 protects the circuit from reverse polarity of the supply voltage.

Construction

As the photos show, both the transmitter and the receiver are built on silk-screened PCBs. Starting with the transmitter, as usual fit the resistors, the two inductors and the capacitors first, followed by the transistors and the LED. Make sure you correctly identify the transistors, particularly the BC548 and BC558.

As the photos show, the photodiode is fitted in the supplied plastic case so it sticks out far enough to pick up the IR output from the remote control unit. The case is attached to the underside of the remote control unit with Velcro tape (also supplied in the kit). The photodiode is positioned so its active surface is pointing towards the IR LEDs in the remote control, spaced a few centimetres away. The actual position is not critical, although it's important that the photodiode is not too close, as it can be overloaded and give a distorted output.

To fit the photodiode, drill two holes in the case for the leads, and solder these leads to the PCB with short lengths of hookup wire. Use small dobs of glue around the leads to hold the photodiode in place.

The receiver board is constructed in much the same way. An IC socket is not essential for IC2, but it makes repairs easier. As already explained, the voltage regulator IC and electrolytic capacitor C4 are not included in the kit, as these compo-

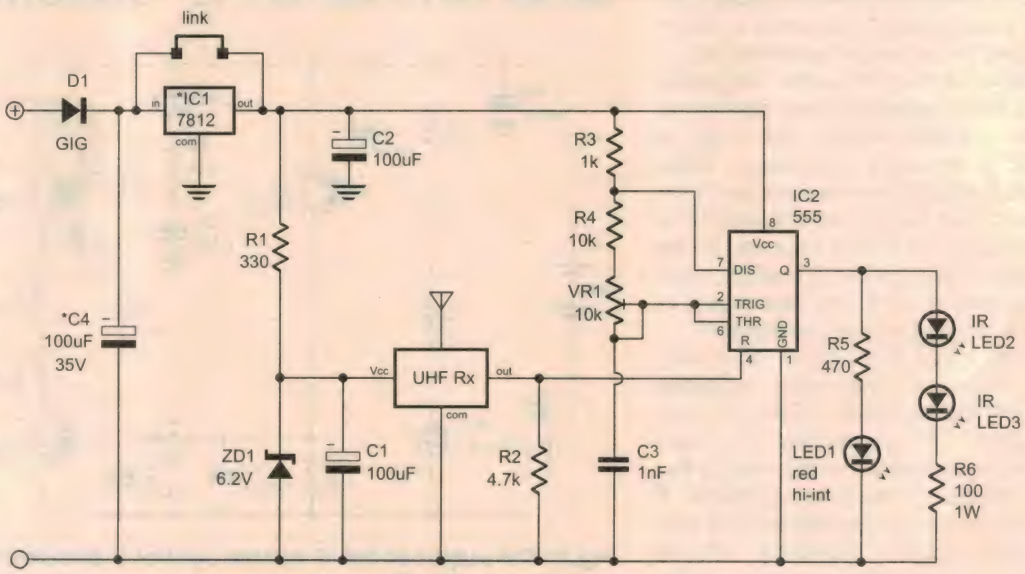


Fig.3: The UHF transmission is received by the UHF module, and its output is the original code from the IR remote control unit. This output switches IC2, a 555 timer connected as an astable running at around 40kHz. When the oscillator is enabled, it drives the IR LEDs which supply the infrared control signal. LED1 gives a visual indication of the output.

*IC1 and C4 not supplied with the basic kit. These components not needed for 12V operation, install link instead
For 24V operation, install these components and leave the link out

nents are only needed for a supply voltage greater than 15V. Fit the link for supply voltages less than this, otherwise leave out the link and fit the extra components.

The receiver module needs two small modifications to (a) convert the output stage of the module from a high gain amplifier to a comparator, and (b) to adjust the frequency to 304MHz. To do this:

1. Cut one end of the 100k resistor located between pins two and three of the IC (2904D). Solder a 3.9M resistor between pins two and four of the IC. As shown in the photo, this resistor is mounted on the track side of the module.

2. Solder a 2pF (or 2.2pF) capacitor across the 10pF capacitor located next to the tunable coil. Make sure the leads of the capacitor are as short as possible. Or, remove the 10pF capacitor and replace it with a 12pF capacitor.

Once these alterations are done, fit the module to the board. Also fit the LEDs, leaving enough lead length to allow the LEDs to poke through holes in the case.

Testing

There are two adjustments to make: aligning the transmitter and receiver frequencies, and adjusting the carrier frequency of the receiver's IR signal output.

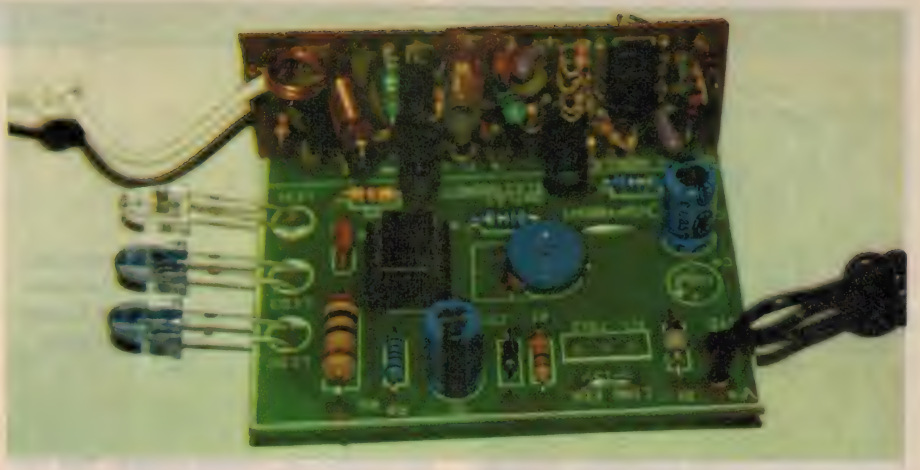
To start with, attach the transmitter case to the remote control unit you are using, and fit the 9V battery to supply the transmitter. If possible, measure the current taken by the transmitter. It should be almost zero, or at worst two or three microamps. If the current is more than this, it probably means the photodiode is exposed to light and is switching the transmitter on. To prevent this, cover the photodiode with black plastic tubing, with a small hole cut in the tubing to allow the IR output from the remote control to strike the sensitive area of the photodiode.

Now confirm that the transmitter takes current only when a button is pressed on the remote control. If so, you can now align it with the receiver. Apply 12V DC (or so) to the receiver board, and place it close by the transmitter. Adjust the trimmer capacitor on the transmitter so the LED indicator on the receiver flashes when a button on the remote control unit is pressed. If necessary, tune the slug in the only tunable inductor on the receiver module.

Increase the distance between the receiver and transmitter and repeat the adjustment until you have achieved the best sensitivity. Note: you should do this adjustment with the transmitter in its plastic case, using a proper non-metallic alignment tool. You might find the frequency of the transmitter changes slightly when you hold the assembly, so adjust it for best sensitivity under typical operating conditions.

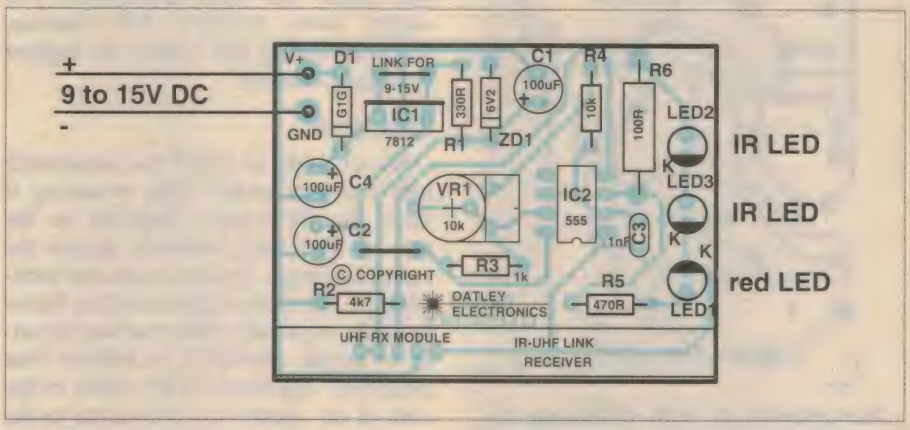
You now need to set the IR carrier frequency. To start with, set the trimpot (VR1) to around its three o'clock position. Point the receiver so its IR LEDs are facing the equipment being controlled, and fine tune the carrier frequency by trial and error. You could also try setting it with a frequency meter to 40kHz.

Once the system is working, fine tune the UHF frequency to give the best results. The code can be distorted if the

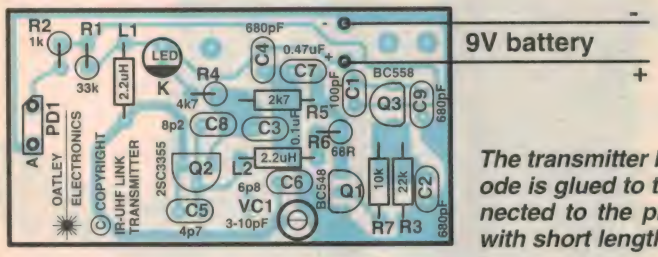


This shot shows the receiver PCB. As described in the article, there are two modifications needed in the receiver module. The receiving antenna is a short length (20cm or so) of hookup wire.

Below: The layout of the receiver PCB is shown here. See the text and below for details on modifying the receiver module.



This photo shows the modifications needed on the receiver module, in which a 3.9M resistor is fitted between pins two and four of the IC (2904D), after removing the 100k resistor between pins two and three. The 2pF capacitor is soldered in parallel with the existing 10pF capacitor fitted next to the tunable coil.



The transmitter layout. The photodiode is glued to the case and is connected to the printed circuit board with short lengths of hookup wire.

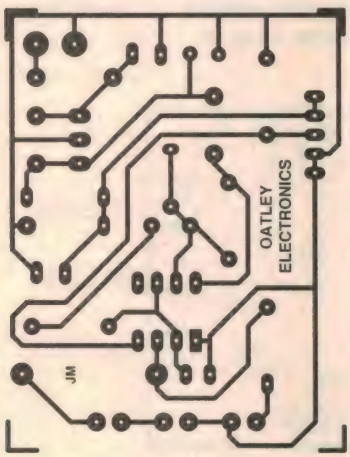
transmitter and receiver frequencies are not correctly aligned, even though the indicator LED in the receiver is flashing. Incidentally, it's usual for this LED to occasionally flash at random, due to noise pickup. It should not flash repeatedly, except when the transmitter is operating.

Setting up

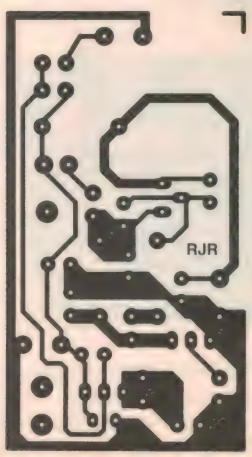
Once you've tested the system, it remains to install the receiver in the room with the equipment being controlled. Its position will obviously depend on your setup, and in my case, the receiver is on the opposite wall to the equipment, above a door. The distance between the equipment and the receiver is about five metres.

If you have a lot of remote controls, you might consider replacing them with a universal learning remote. These vary in price, but are sometimes available as specials, at around $30. This also lets you control all your equipment via the IR-UHF system.

The operating distance between the UHF transmitter and receiver will depend a lot on the environment. A distance of 10 metres or more is typical, and under the right conditions, you might even achieve 100 metres. Accurate tuning will ensure the highest operating distance.



The artwork of both PCBs, reproduced full scale for readers wanting to make their own. The design is copyright to Oatley Electronics.



Options

It's possible to build the transmitter into a remote control unit, powering it from the 6V supply (typical) in the remote. This will, however, reduce the operating range. To fit it inside the limited space, lay all the components as flat as possible, especially those that are intended to mount vertically. To achieve best frequency alignment, drill a hole in the case of the remote to give access to the tuning capacitor on the transmitter, and do all adjustments with the case closed.

Locate the photodiode alongside the IR LEDs in the remote, linked to the board with hookup wire, or better still, with a length of thin coax. Power the transmitter from the batteries in the remote, but make sure the transmitter board is not contacting any conducting part of the remote control unit.

You might find that although the transmitter output is omnidirectional, there are a couple of "dead" spots. If this causes a problem, consider making a second receiver and position it to pick up the transmission when the other receiver does not. You can power several receivers from the one power supply.

If you want to increase the operating distance, you might build two systems, with one acting as a repeater. That is, the transmitter in the remote control unit

(Continued on page 89)

PARTS LIST

Receiver

Resistors (1/4W unless indicated)

R1	330 ohm
R2	4.7k
R3	1k
R4	10k
R5	470 ohm
R6	100 ohm 1 watt
VR1	10k trimpot

Capacitors

C1,2,4	100uF 35V electrolytic
C3	1nF polyester

Semiconductors

IC1	7812 (if needed)
IC2	555 timer
ZD1	6.2V zener diode
LED1	5mm red LED
LED2,3	5mm IR LED
D1	G1G or similar power diode

Miscellaneous

304MHz receiver module, 8-pin IC socket, plastic case 80 x 53 x 27mm, 12V DC plugpack or equiv., PCB 60 x 45mm.

Transmitter

Resistors (all 1/4W)

R1	33k
R2	1k
R3	22k
R4	4.7k
R5	2.7k
R6	68 ohm
R7	10k

Capacitors

C1	100pF ceramic
C2,4,9	680pF ceramic
C3	0.1uF ceramic
C5	4.7pF ceramic
C6	6.8pF ceramic
C7	0.47uF monolithic
C8	8.2pF ceramic
VC1	3-10pF PCB mount trimcap

Semiconductors

Q1	BC548 NPN transistor
Q2	2SC3355 NPN transistor
Q3	BC558 PNP transistor
PD1	BPW50 photodiode
LED1	5mm red LED

Inductors

L1,2	2.2uH

Miscellaneous

PCB 60 x 32mm, plastic case 122 x 27 x 24mm, 9V battery and battery clip.

A kit of parts for this projects is available from:
Oatley Electronics
Phone (02) 9584 3563
Postal address (mail orders):
PO Box 89, Oatley NSW 2223.
Both PCBs, all on-board components, Velcro strap, plastic boxes $35.
Suitable surplus plugpack $7.50
Post and pack charges $5

SHORTWAVE LISTENING

with Arthur Cushen, MBE

The checkered career of Belgium Radio

Broadcasting commenced in Belgium in 1932, but due to the war the transmissions were shifted to the Belgian Congo and only in 1947 were normal transmissions resumed from the homeland.

Radio Vlaanderen International, the Voice of the Flemish community in Belgium, is a well known signal on shortwave and has a long history of international broadcasting. The present schedule period up to October 26 remains in force with our best reception in English 0630-0700 on 9925 and 9940kHz, but after October there is to be some reduction in the English language programmes, particularly to Europe.

On 23 May 1934 the RTT started daily transmissions to the Belgian Congo (now Zaire), from a shortwave transmitter at Ruyselede in West-Flanders. The 90-minute programmes consisted of one hour of music, 15 minutes of news in Dutch and 15 minutes of news in French. This was disrupted when on 14 May 1940 the transmitter was destroyed by the German army.

On September 28, 1940 a new free Belgian voice was heard in Europe. The initiative was taken by the BBC in London and programmes were under the control of the British Ministry of Information. The programme was called Radio Belgique and was very popular in occupied Belgium; it became world famous when one of the presenters, Victor de Laveleye invented the 'V sign' — soon popular within the entire BBC and adopted by Prime Minister Winston Churchill.

On 1 October 1940 the London-based Belgian government in exile established Radio Belgian Congo in Leopoldville. The programmes were not only for the Belgians in the colony but also, via a modest 7.5kW shortwave transmitter, for listeners in occupied Belgium. In 1942 the Belgian government purchased a 50kW transmitter in the USA and had it shipped to Leopoldville, where it started transmitting on 16 May 1943. These broadcasts were well received in the South Pacific and one of the highlights of wartime listening was when the Belgian government at Leopoldville and the French exile government at Brazzaville, across the Congo River, were both heard with broadcasts beamed to Europe.

In 1952 a new transmitting site became operational. The centre at Waver, south of Brussels had two 150kW mediumwave transmitters for national programmes in Dutch and French, two 100kW shortwave transmitters for the international service, with three mediumwave and eight shortwave antennas. The eight shortwave antennas are still in use. In the mid-sixties four modern curtain antennas were erected at the Waver site, used for transmissions to Africa, and in 1974 two new 250kW shortwave transmitters were added.

In 1970 the world service was split up into two separate departments — French and Dutch speaking respectively. These were able to use separate frequencies for most transmissions, a move greatly facilitated by the acquisition in 1974 of the two new transmitters. This first step was followed in 1976 by the complete divorce of BRT and RTB, including the international service. The French speaking RTB immediately reduced its transmission time. The RTB continued its broadcasts in French, targeted at Southern Europe and Africa, while the BRT limited its production to programmes in Dutch, English and Spanish.

1992 was another crucial year in the history of the station. On September 26 the station changed its name to 'Radio Vlaanderen International'.

New RNZ studios

The Government of New Zealand recently decided to build a $94M office block to house the expanded Cabinet, and in order to make this expansion the present Broadcasting House adjacent to Parliament buildings has to be destroyed.

Radio New Zealand has moved to a new studio complex in what is now called Radio New Zealand House in Wellington. Radio New Zealand National programme and Concert FM is on the second and third floors as well as news, archives and the administration side of RNZ. The shortwave service Radio New Zealand International is on the fourth floor and this area consists of four studios, two control rooms and a continuity booth. The operation from this site has meant a tremendous amount of work in moving thousands of recordings, equipment and all the other technical material. ❖

AROUND THE WORLD

ALBANIA: Radio Tarana broadcasts in English to North America at 0245 on 7160kHz and is also heard with a session to Europe at 1845 on 9570. The broadcasts from Radio Tarana over recent months have resulted in keen listener interest in this broadcaster.

FRANCE: RFI, Paris has English to Asia 1200-1300 on 11,600kHz and 1400-1500 on 15,405kHz according to the latest schedule.

MEXICO: XERMX, Radio Mexico International is heard on 5985 at 1200 after VOA Delano leaves the frequency. The station has an English announcement at 1230 but Asian interference at 1300. Better reception is had on 9705kHz, which is clear throughout this period and good identification at 1300UTC.

NIGERIA: The Voice of Nigeria, Lagos, has resumed a full programme service on 7255kHz between 0500-2300UTC. English is heard 0500-0800, 1600-1700 and 1900-2200UTC. The station is heard opening at 0500 with drum beats at 0503, followed by the national anthem. Sign-on is in English, giving only one frequency (7255kHz) but there is severe Arabic interference from VOA. The Voice of Nigeria stopped broadcasting in late 1995 when its last transmitter broke down; they acquired new transmitters from Switzerland and have been testing on an irregular basis since 1996.

SOUTH AFRICA: The latest schedule from Sentech indicates that the transmitters at Meyerton are used by the following: Channel Africa, BBC, Radio Sonder Grense, Radio France International, Amateur Radio League, Trans World Radio and World Music Radio. RFI uses 250kW in French to Central and East Africa from 0300-0355UTC on 7135kHz. The balance of the schedule is very extensive for the other users.

USA: WINB in Red Lion PA is heard from 0500-0600 with continuous gospel music on 11,950kHz. The only announcement was at sign-off when they indicated the test was beamed to Mexico.

Radio Free Asia broadcasting in Vietnamese 2330-0030 is heard only on 11,580 and 13,710kHz. There is light jamming on the frequencies and 11,580kHz is the better signal. All other frequencies are not audible except 9975kHz, which was not in Vietnamese but carrying an English gospel programme.

UNITED KINGDOM: Part of the BBC World Service has been privatised and this is the programme delivery service which includes Asia and the Pacific. This is now operated by Merlin Communications International Ltd. There have been some staff changes and a new fax and room number at Bush House. The monitoring and other activities continue the same under the new private company. ❖

This item was contributed by Arthur Cushen, 212 Earn Street, Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind New Zealand Standard Time.

Mini Construction Project:

ACCELEROMETER MODULE

They're in cars, boats and submarines, but until recently you may not have known they were there. They're accelerometers, and they use the latest in silicon manufacturing technology to give high performance in a small space. This project is based on a small evaluation kit available from Analog Devices, and it will allow you to explore the capabilities of these versatile sensors.

by GRAHAM CATTLEY

One of the more interesting facets of modern silicon processing techniques is the idea of etching silicon to provide mechanical as well as electrical properties. Known as *micromachining*, this process involves etching away some layers of silicon while leaving others, resulting in minute silicon structures that are free to bend, twist or turn.

One of the first companies to exploit micromachining is Analog Devices, who employ the process in the manufacture of their ADXL05 and ADXL50 accelerometer ICs. These ICs are widely used in automotive airbag systems, and can measure accelerations of up to 5*g* with the ADXL05, and 50*g* with the ADXL50. (Note that the symbol *g* is used to denote gravity, and shouldn't be confused with the more common 'g' used for gram.)

These sensors measure the force applied to an internal micromachined piece of silicon, and can measure vibration, tilt, acceleration, velocity and shock.

Analog Devices have produced an evaluation kit for the ADXL05 sensor which consists of the sensor, a miniature PC board, and a collection of SMD components that allow you to configure the device to produce an output voltage of 200mV/*g* up to 1V/*g*.

After building up the evaluation kit and playing around with it for a while, we thought that our readers would be interested in experimenting with this interesting device, so we designed an ultra simple interface that supplies power to the sensor, and will let you measure the sensor's output with a data logger or sampler such as the Pocket Sampler we described in the August 1996 issue.

Before we talk about using it, however, we might look at the internal structure of the sensor, and some of the support circuitry inside the IC.

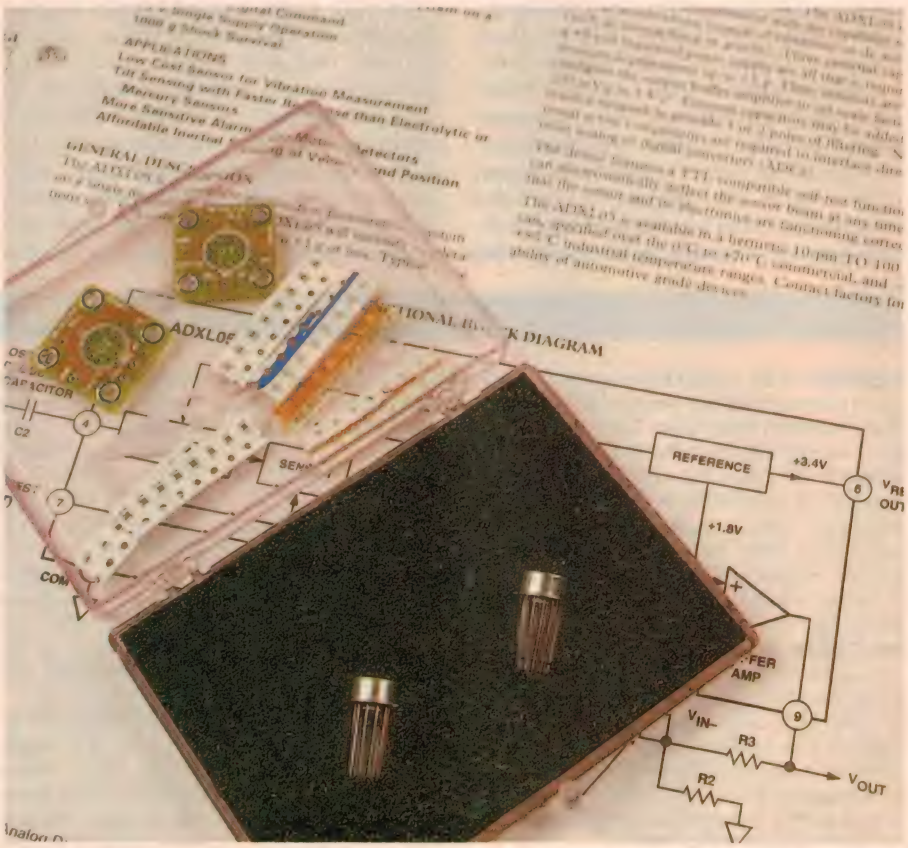
How it works

The accelerometer itself is a differential capacitive sensor which consists of 46 pairs of fixed capacitor plates, with a separate movable plate positioned between each pair. Each one of these movable plates is attached to a main silicon 'beam'. This beam is a micromachined slab of silicon around 200um long, supported at the ends by minute silicon springs only 2um thick. These springs allow the beam to move along its axis in response to applied acceleration.

The capacitors formed by the fixed plates and the moving central plate form a series-connected capacitive divider with the common movable plate effectively becoming the center tap of two series connected capacitors (see Fig.1a).

All of the sensor's fixed capacitor plates are driven differentially by a 1MHz square wave, with each of the pairs of plates receiving square waves that are equal in amplitude but 180° out of phase. When the sensor is at rest, the values of the two capacitors are the same, and therefore the voltage output at their centre tap (i.e. at the moveable centre plate) is zero.

Fig.1b shows the position of the sensor's beam when the sensor is accelerating; when this occurs, the common central plate moves closer to one of each pair of fixed plates, while moving further away from the other. This creates a mismatch in the two capacitances, producing an output signal at the central plate that is directly proportional to the



The ADXL05 Starter Pack from Analog Devices contains two accelerometer ICs, along with a pair of PCBs and nearly 50 SMD components. There's also a stack of data sheets and application notes to keep you going as well.

applied acceleration.

By the way it is important to keep a sense of proportion here — the distance the beam moves is in the order of micrometres, and the resulting capacitive change is in the order of a few *attofarads* (10^{-18}F); small, by anyone's standards!

Control systems

Fig.2 shows a block diagram of the sensor and control systems inside the ADXL05, as well as the external components which will be described later. The voltage output from the central plate of the sensor is buffered and then applied to a synchronous demodulator, which is clocked with the same oscillator that drives the fixed plates of the sensor.

If the sensor is accelerating forwards, its output will be in phase with the reference clock signal, and the demodulator will produce a positive DC output. If, on the other hand, the sensor is accelerating backwards (or decelerating), the output signal will be 180° out of phase with the clock, and the demodulator's output will be negative.

The output of the modulator drives a preamplifier which in turn feeds back to the sensor via a high value resistor. The voltage necessary to electrostatically hold the beam in its centre position is 1.8 volts and this voltage is presented on Vpr (pin 8) of the IC. When subject to acceleration, the output voltage of the demodulator changes, and thus a higher voltage is needed to keep the beam located centrally. It is this 'correction' voltage that is used to determine the force acting on the sensor. At rest, the sensor produces a voltage of 1.8V, and this increases at the rate of 200mV per *g*, to the sensor's upper limit of 5 gravities.

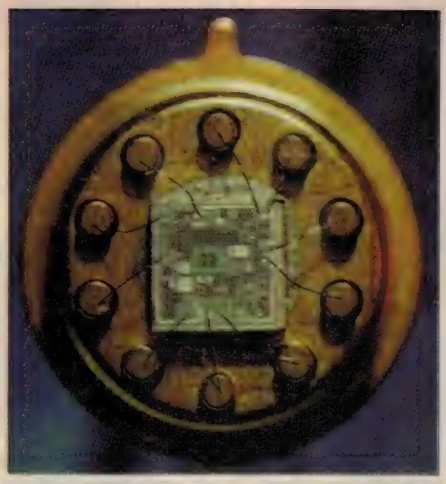
The correction voltage is then passed through an external resistor to the input of an on-board buffer amp, which can be configured to give AC or DC gain, allowing the unit to produce output signal levels of up to 1V/*g*.

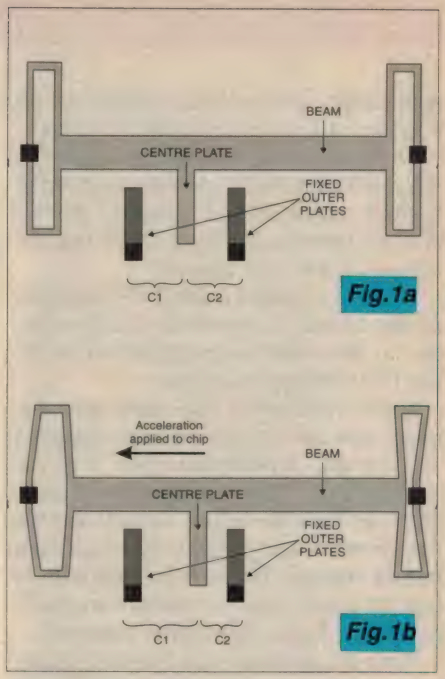
Evaluation kit

The evaluation kit available from Analog Devices provides a simple way to use the ADXL05 in a number of different configurations. The sensor is mounted on a tiny (20mm square) PCB, along with half a dozen surface mount resistors and capacitors.

The kit actually contains two ADXL05 accelerometer ICs, and around 50 SMT resistors and capacitors. Only a few of these components are actually used, however, with a data sheet showing which components to install where on the board.

Fig.2 is also a schematic diagram of the evaluation board, with Table 1 giving the values for the various components in the circuit, depending on the full scale range and sensitivity required. In the prototype we decided on a sensitivity of +/-2*g*, and a buffer gain of two. This results in a voltage output of 400mV from the module per gravity unit, and should suit most applications.





Above is a close-up of the accelerometer IC, where you can just see the aqua sensor area on the chip. At right is a simplified diagram if the sensor, showing how it moves during acceleration.

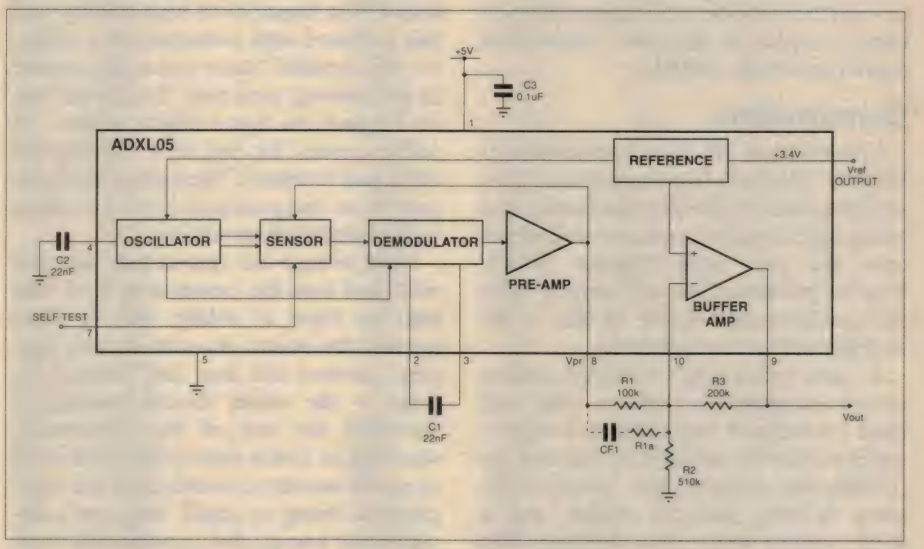


Fig.2: This diagram shows both a block diagram of the operation of the accelerometer IC, and the external SMD components used to set the gain and filtering. The values shown here give a 5V output for an acceleration of two gravities.

Pocket sampler

Perhaps the cheapest and easiest way to monitor and record the output from the accelerometer is to use the Pocket Sampler that was presented in the August 1996 issue. This allows you to graphically view the waveforms produced in real-time, and save the results to disk to be analysed later (more about this analysis later).

One problem with this setup is that the kit can produce a maximum output voltage of 5V, while the sampler has only the two input ranges of 2V and 20V. to get around this, we designed a small PC board that contains a simple resistive divider which attenuates the incoming signal by 40%, giving a 0 - 2V output for a 0 - 5V input. This scales the voltage put out to the BNC socket to 2V, and gives the best resolution on the pocket sampler.

Of course you can vary the level of attenuation by changing the values of R4 and R5 on the board to suit your

application, or even leave them out all together to give you the full 5V signal.

(Why don't we just select values for R3 and R2 on the kit module, to give the desired output range? Simple: the kit doesn't include the right SMT resistor values for a 0 - 2V output.)

We also included a small 5V regulator on the board to power the accelerometer, so the whole unit can run off a 9V (or 12V) battery if desired.

A test button has also been incorporated into the design, and this supplies +5V to the self-test pin (pin 7) of the ADXL05 IC. This voltage electrostatically deflects the silicon sensor, and the sensor will then produce its maximum output voltage. This can be used both to test the sensor, and to simulate an acceleration of 5*g* for calibration purposes.

Both the attenuator and power supply are mounted on a 28 x 28mm PCB, and this is really all the interfacing that you need in order to get quite impressive results out of the module.

TABLE 1: ADXL05 TYPICAL COMPONENT VALUES

FULL SCALE RANGE	BUFFER GAIN	SCALE FACTOR IN mV/*g*	R1	R3	VALUE OF R2 FOR +2.5V 0*g* LEVEL	DESIRED HIGH FREQUENCY LIMIT, F_H	CF2 VALUE	TYPICAL RMS NOISE LEVEL
+2*g*	2.0	400	100k	200k	510k	8Hz	0.1uF	1.7m*g*
+2*g*	2.0	400	100k	200k	510k	36Hz	22nF	3.7m*g*
+5*g*	1.0	200	200k	200k	510k	100Hz	8.2nF	5.9m*g*
+5*g*	1.0	200	200k	200k	510k	1kHz	NONE	19m*g*
+5*g*, -4*g*	1.0	200	510k	510k	NONE (+1.5V 0*g* LEVEL)	3Hz	0.1uF	1m*g*

This table shows which value SMD components to use, depending on the sensitivity required. You can also select the values of the filter components if required as well.

Construction

Construction of the Accelerometer Module falls into two main areas: constructing the small interface board, and soldering the surface mount components onto the tiny accelerometer board. You're probably best off starting with the accelerometer board, as this is the trickiest part of the assembly.

In case you haven't soldered surface mount components before, you will need (in order of importance): a soldering iron with the smallest tip you can get (preferably temperature controlled); some 0.7mm diameter solder; and a work surface with good lighting. The way to solder these tiny devices is what's known as *reflow soldering*. That is, the solder is applied to the pad, the component is positioned on the board, and the solder is then re-heated, causing it to flow around the joint.

To begin, select a component (capacitors are usually larger and easier to start on), and locate its solder pads on the PC board. The board is of high quality and silk screened with a component overlay, so you shouldn't have too much trouble in positioning each part. *Lightly* tin one of the pads so that a slight 'pillow' of solder covers the pad area, leaving the other pad untinned. Then place the component on the pads and hold it in place with a toothpick or similar.

Now re-heat the tinned pad and you will find that the component will sink into the layer of solder, and lie flush against the board. As soon as this happens remove the iron and inspect the joint — the solder should completely surround the end of the component, resulting in a nice clean joint. One thing to watch out for is overheating the components; being so small, they can't dissipate the energy fast enough and overheat quickly.

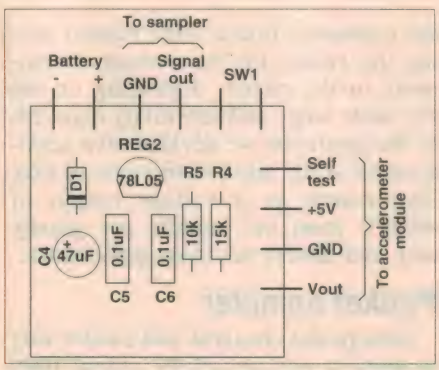
When you are happy that the joint is alright, you can then solder the other end using a minimum of solder on the joint.

Once you've installed all the surface mount components in this way, you can mount the ADXL05 IC. It mounts on the top of the PCB (as opposed to the bottom, where you just mounted all the surface mount components), with its tab pointing away from the three off-board connection pads. Push the IC as far as it will go into the board, and slightly splay the leads to keep it in place. Quickly solder each lead in turn, clipping off the excess as you go.

Once you've finished the accelerometer board, soldering the parts onto the larger power supply/attenuator board will be easy. But before you start, you might like to change the tip of your soldering iron back to its normal size...

Install and solder the 10 PC terminal pins around the two edges of the board, followed by the two resistors and the diode. Follow up with the three capacitors and the regulator, checking their polarity before soldering them in.

Using short lengths of ribbon cable, connect the BNC socket, test switch and accelerometer board to their respective PC pins, using the component overlay



Above is the overlay diagram for the small interface board, while the two photos show the top and bottom of the smaller accelerometer board.

diagram as a guide. If you look in one of the photos, you'll see how the ribbon cable was trimmed to match the location of the pads on the accelerometer PCB, with the power connections made on the bottom of the board.

You can now connect a 9V battery snap to the power supply board, and mount both boards securely to the bottom of a small Zippy box. I say *securely* because due to the very nature of this project it will be subject to a fair degree of knocks and bumps, and you don't want things rattling around.

Another reason for bolting things down is that it prevents the PC board and case vibrating and interfering with the reading. This is why the accelerometer IC is mounted on a small thick (2.5mm) board — by keeping things small, the board is less prone to resonance. One last point is that the sensor module should be mounted so that the tag on the ADXL05 faces one of the ends of the box, so that the axis of sensitivity of the device matches the arrows on the lid.

Tilt!

With the components shown in the schematic diagram, the accelerometer will produce a 0 to 5V signal as the module is accelerated from 0 to 2 gravities. An important point to note here is that the accelerometer cannot tell the difference between acceleration and the effects of gravity in its sensitive plane.

This means that if the sensor is tilted, the accelerometer produces an output that is proportional to the sine of the angle of tilt. Depending on your application, this can be a help or a hindrance — obviously if you want to measure tilt then this is just the go: a resolution of 0.005*g* resolves to an angular resolution of 0.5° over the range of 0-70 degrees. (This falls off to 1° at 75°, 3° at 80° and 6° at 90° due to the sinusoidal output characteristics of the sensor.)

The problem comes, however when you want to use the accelerometer to measure *acceleration*, because during the measurement the sensor needs to be kept completely level. As the sensor can't differentiate between acceleration and gravity, any tilt in the device will be seen as extra acceleration and so give a false reading.

This problem can be alleviated by replacing the surface mount resistor R1 with a series-connected resistor and capacitor combination. There are spare pads on the board for doing this, and as you can see from the schematic these AC-couple the output from the sensor's preamp to the main output buffer amplifier. These extra components are provided as part of the kit, and their values can be calculated from the supplied table.

The completed accelerometer module. The test button lets you simulate an acceleration of 5 gravities, with the 0 to 5V output signal available through the BNC connector.

With these components in place, however, only the *change* in acceleration will be measured — a steady rate of acceleration will result in a DC value which is blocked by the coupling capacitor. This will eliminate the tilt offset problem; but remember that in any case, the sensor only measures in the one plane — if the sensor is tilted then it will be less sensitive to acceleration or deceleration in that plane.

Analysis

If you use a digital sampler (like the Pocket Sampler) to log the readings from the accelerometer over time, it is possible to calculate the distance the sensor

PARTS LIST

Resistors

R4	15k
R5	10k

Capacitors

C4	47uF 16VW electro
C5,6	0.1uF MKT

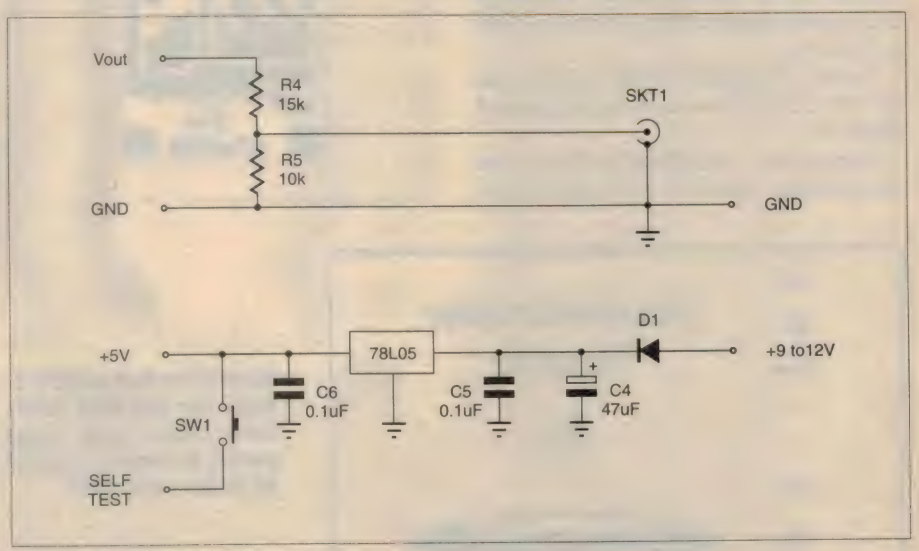
Semiconductors

D1	1N4148 signal diode
REG1	78L05 5V voltage regulator

Miscellaneous

PC board 28 x 28mm, coded 97am9; plastic box, 52 x 82 x 30mm; SPDT mini toggle switch; miniture N.O. pushbutton; Panel mount BNC socket; hookup wire, nuts, bolts, spacers etc.

The Analog Devices ADXL05-SP Starter Pack is available from Insight Electronics for around $85 plus $12 delivery to anywhere in Australia. Individual accelerometers are available as well. The address for Insight is: 4/124 Forest Rd., Hurstville, NSW 2220; phone (02) 9585 5000, or fax (02) 9580 6723.



The simple interface circuit consists of a resistive divider and a 5V power supply. The terminals at left go to the accelerometer PCB.

moved along its axis of sensitivity.

A spreadsheet program would probably be the easiest way to do this, although you could write a program in BASIC or C to achieve the same result. If you decide to use a spreadsheet, you might try something like the following — which will give you both the velocity of the sensor at any one time, as well as the total distance the sensor travailed along its axis.

First, take a reference reading by setting the sensor on a level surface and call this **Vref1**. Then take a second reading with the sensor standing on end. This second reading (call it **Vref2**) subjects the sensor to a force that is equivalent to an acceleration of 9.81m/sec^2 (one gravity). You'll also need the sampler's sample time, which can be calculated by dividing the total sampling period by the number of samples. Call this **Tref1**.

Once you have these three values, start sampling, and move the sensor along its sensitive axis for a short distance. (Keep in mind the maximum number of rows your spreadsheet can handle, as you don't want to record too much data — 1000 readings at one or two milliseconds each should do for starters.) Save the data to a file, and then import it into the first column of your spreadsheet (column A). Then apply the following formulas to columns B to G:

Column B: (**A1-Vref1**) Subtracts the offset voltage recorded when device was at rest.

Column C: (**B1*((Vref2-Vref1)/9.82)**) This converts the readings to m/s^2.

Column D: ((**C1+C2)/2**) Averages the instant accelerations from one cell to the next.

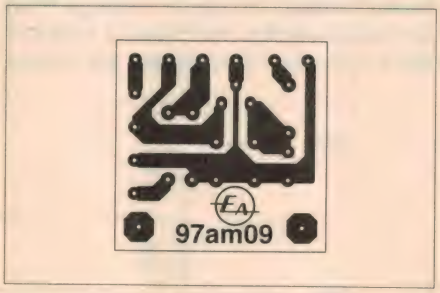
Column E: (**D1*Tref1**) Gives you the velocity over each sampling period (delta-V).

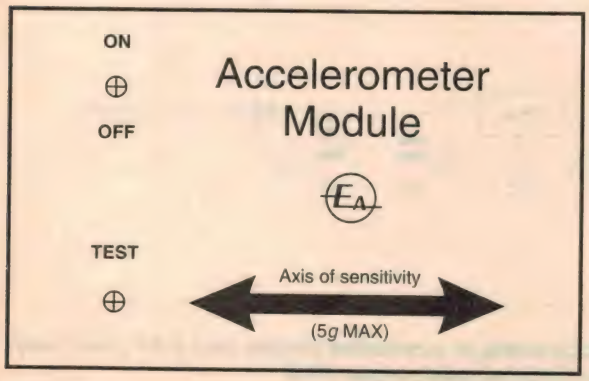
Column F: (**E1*Tref1**) Gives you the distance traveled over each sampling period (delta-D).

Column G: (**G1+F2**), Gives the cumulative distance traveled.

This all sounds a bit complicated on paper, but it is simply a matter of entering the six formulas along the first row, and then copying them down the columns.

This shot inside the box shows how everything is bolted down. Use some double-sided sponge tape to keep the battery in place, and some foam packing to stop things moving around.





Here's the full sized artwork for the little interface board and front panel, in case you want to make your own.

More sensors

Such a system works well for movement in one direction, but it can't discern movement in either of the other two planes of movement. To allow two or even three dimensional measurements to be taken, extra sensors will be needed — one for each dimension. As the evaluation kit from Analog Devices contains two sensors as well as a second PCB, you should be able to get a second unit up and running in no time.

The task of recording the data from this extra sensor is perhaps beyond the capabilities of simple sampling systems such as the Pocket Sampler, as readings from both sensors would need to be taken at the same time.

With a three-sensor system, sophisticated positional sensing is possible, with devices able to automatically generate terrain maps, enable submarines to navigate using dead reckoning, and allow the 'scanning' of three dimensional objects into a computer.

As you can see, these acceleration sensors can be put to a multitude of uses now that micromachining technology has cut the size and price of these sensors by a factor of over a thousand. With further refinements in the pipeline, accelerometers will start appearing in more and more facets of everyday life. ❖

NEW BOOKS

Digital audio

PRINCIPLES OF DIGITAL AUDIO, by Ken C. Pohlmann. Third edition 1995, published by McGraw-Hill. Soft cover, 236 x 188mm, 622 pages. ISBN 0-07-050469-5. RRP $110.

The third edition of a book which has been extremely successful, even though author Ken Pohlmann says he was virtually talked into writing the original 1985 edition, because he didn't think there'd be enough interest in the subject. Little did he realise then what the next decade would bring — and that the technology would keep surging right on!

Professor Pohlmann is of course a recognised authority on digital audio, with many hundreds of published articles on the subject (including some in *EA*, some years back). He has also received a Fellowship Award from the Audio Engineering Society, for his work as an audio, consultant and educator.

To me, at least part of the reason why the previous editions of this book were so popular is that he's particularly good at explaining basic concepts. However in this third edition he has not only added new material to cover recent developments in technology, but also gone back to the basic chapters and given them a thorough update/revision as well. As he says in the preface, this edition is 'a whole new ball game'.

There are now good meaty chapters on perceptual coding, MiniDiscs, DSP (digital signal processing), low-bit conversion and noise shaping, and DAB (digital audio broadcasting). And like the rest of the material they're written in Pohlmann's concise but accessible style, with plenty of illustrations.

Even more so than with the earlier editions, then, it makes an excellent primer and reference on modern digital audio technology.

The review copy came from McGraw-Hill Australia, of 4 Barcoo Street, Roseville 2069. (J.R.)

Opto Electronics

PRACTICAL OPTO-ELECTRONIC PROJECTS, by R.A. Penfold. Published by Bernard Babani 1994. Soft cover, 110 x 180mm, 150 pages. ISBN 0-85934-349-9. RRP $13.95.

As this book points out, in recent years the range of opto devices suitable for hobbyist use has expanded. These now include LCD screens, laser products, 'intelligent' opto-sensors, hi-intensity LEDs, even white LEDs. Infrared devices are now becoming more popular, particularly since the advent of low cost CCD cameras.

So this little book is timely in that it covers a topic that is often relegated to a single chapter in an electronics book. It is divided into three chapters, all of which present a number of built it yourself projects. The first chapter covers infrared devices, and describes how to build devices like a broken beam detector, passive IR detector, broken beam camera trigger and a passive IR alarm.

The next chapter is about photographic projects, and is the shortest chapter with 26 pages. Projects that are explained include a remote control trigger for a camera, flash slave, enlarger exposure meter, colour temperature meter and a shutter timer. The last chapter is called Modulated Light Transmission, and presents details of a light link, an audio isolator, and IR communication link, cordless headphones, and a fibre optic data link.

All projects in the book are fully described, with a circuit diagram and parts list. The parts are all commonly available. There are no circuit board designs, but most of the circuits are easily built on strip board. The author also gives some basic theory on light, but in general the book is mainly projects. The writing style is friendly and there is virtually no mathematics.

The review copy came from Jaycar Electronics, and it's available from your nearest Jaycar store, with the catalog number BB2039. (P.P.)

Handy dictionary

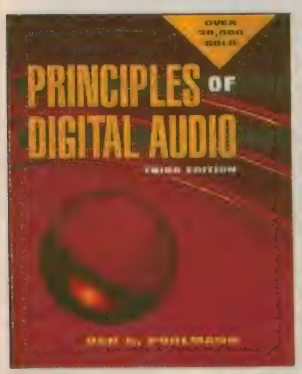
NEWNES DICTIONARY OF ELECTRONICS, by S.W. Amos and R.S. Amos. Third edition, 1996, published by Butterworth-Heinemann. Hard covers, 223 x 142mm, 363 pages. ISBN 0-7506-2405-1. RRP $65.

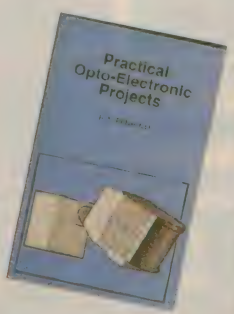
The third and expanded edition of this very handy dictionary of electronics terms, written by experienced British writer/editor S.W. Amos and his son Roger. If I remember rightly Mr Amos senior was an editor of *Wireless World* magazine for some years, and has written many articles and books over the years.

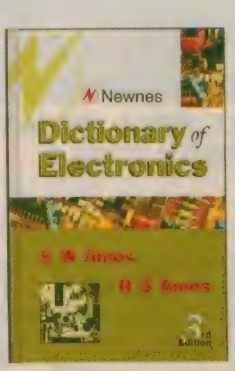
This edition of the dictionary contains some 400 new definitions, many of them associated with computers and digital technology, and quite a few of the existing definitions have also been revised in the light of recent developments. These additions and revisions have certainly brought it reasonably up to date — although as with any reference of this type, it's always possible to find omissions. For example I looked in vain for an item defining Zobel networks, or Ayrton shunts, or band-gap voltage references.

But on the whole, it's quite comprehensive enough for most purposes, and would generally make an excellent resource for anyone just getting into electronics either as a student or hobbyist. There are a useful sprinkling of illustrative charts and diagrams, and an appendix at the back explaining a reasonable number of commonly used abbreviations and acronyms (although not DSP or CDMA).

The review copy came from Butterworth-Heinemann Australia, of 18 Salmon Street (PO Box 146), Port Melbourne 3207. (J.R.) ❖





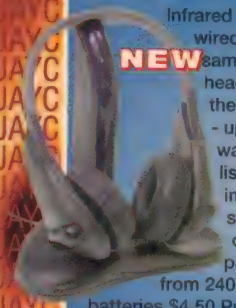


Jaycar ELECTRONICS

RED HOT SEPTEMBER SALE

Prices valid until 30th September 1997

NEW GENERATION RF WIRELESS HEADPHONES



NEW

Infrared cordless headphones are definately better than wired ones, but with infrared IR you had to be in the same room, in line of sight. These new RF headphones change all that! They allow you to use them with complete freedom all around your house - up to 30 metres away. RF goes through floors, walls, etc. So, you can even mow the lawns while listening to the stereo!! And, with Jaycars' direct importing, you can save big $$ over others' selling prices. Headphones includes a volume control for each ear, and soft comfortable ear pads. Also included is a mains adaptor to run from 240V. 2 x AAA batteries required. Energiser batteries $4.50 Pr Cat. SB-2380.

Specifications: •RF TX frequency 40.68mHz •Frequency response 50Hz to 18,000Hz •S/N ratio >50dB(A) •Trasmit distance 30 mtrs.

MONO Cat. AA-2003 **$69.95 PR**

STEREO Cat. AA-2004 **$99.95 PR**

INDOOR TV AMPLIFIER / SPLITTER

GME Kingray

NEW

Boost your TV signal indoors. The antenna lead is plugged into the amplifier, and there are two outputs for two TVs, both which have a 12dB boost. One outlet can be used for FM stereo if desired. Runs on 240VAC mains, and includes a LED power indicator. Australian made.

Cat. LT-3288 **$49.95**

MAXELL GOLD NEW RECORDABLE CD'S

Best price in town? 74min, 680mB. Cat. XC-4710

Only $8.95

10+ $7.95

100+ $6.95

PIHER HORIZONTAL TRIMPOTS

Features: •Dust proof enclosure •Polyester substrate •Wiper positioned at 50% •Accidental rotor movement protected. Specifications: •Max voltage 100V •Nom power 0.1W •Linear curve •Tolerance +/- 30% •End resistance 10Ω.

Value	Cat#	Value	Cat#
200Ω	RT-4350	20K	RT-4362
500Ω	RT-4352	50K	RT-4364
1K	RT-4354	100K	RT-4366
2K	RT-4356	250K	RT-4368
5K	RT-4358	500K	RT-4370
10K	RT-4360	1M	RT-4372

All One Price 70c ea

2 CHANNEL DP REMOTE CONTROL SWITCH - LATCHING AND MOMENTARY

Now available, a 2 channel version of our remote control switch. Selectable between latching and momentary. Supplied with one transmitter. Extras are available, and are DIP switch coded.

NEW

2 CHANNEL

With one transmitter. Cat. LR-8826

$79.95

Extra transmitters Cat. LR-8827

$19.95ea

1 CHANNEL

With one transmitter. Cat. LR-8828

$59.95

Extra transmitters Cat. LR-8829

$17.95ea

150 WATT SWITCHMODE POWER SUPPLY DEAL NEW

Another surplus bargain. These are removed from new equipment. Input is 240V or 110V via an IEC socket. Outputs are via 9 pin launcher headers. There is even a 2 way launcher for a cooling fan. Output voltages are: •3 x +5 volts @ 10 amps total •1 x +12 volts @ 2.5 amps total •1 x -12 volts @ 1.5 amps total •1 x +24 volts @ 160mA total. Supplied with performance specifications. Board size 287(L) x 126(W)mm. Limited quantity available.

Cat. MP-3045 **Only $39.95ea**

2 WAY ELECTRONIC CROSSOVER NEW

Brand new model. We've found this crossover gives absolutely no noise (even with amp 8 crossover gains at max.) and with bass boost on. The crossover did not clip before the source signal. Due early September. Features: •Remote power terminal block •LED power indicator •Output level controls •Bass boost on/off switch •Mono/stereo switch.•Gold plated RCA in/out socket •Heavy duty metal case (will be grey in colour). Specifications: •Bass gain +/-18dB •Crossover slope - 18dB/0cT •Signal to noise ratio: >80dB. •THD: <0.02% at 1V •Channel separation >65dB •Size 190(W) x 110(D) x 32(H)mm.

Cat. AA-0450 **Only $89.95**

ELECTRONIC SUBWOOFER CROSSOVER

NEW

Putting this in line (low level) with a standard car amplifier will give you an adjustable low frequency output for your sub woofer. Due early September. Features: •Adjustable level control. •Gold plated RCA input/outputs. •Noise suppression inductor built in. Specs: •Adjustable crossover freq - 80Hz, 125Hz, 250Hz. •Crossover slope - 12dB/0cT. •Signal to noise ratio: >80dB. •THD: <0.02% •Size 65(W) x 90(D) x 27(H)mm.

Cat. AA-0475 **Only $29.95**

12V DIL LATCHING MINI RELAY

AVAILABLE ONCE AGAIN!!

DIP style - will plug into 16 pin IC socket. Low profile mini 12V 2 coil latching relay. Highly sensitive - 400mW nominal operating power. Specifications Coil • 2 coil latching • 12 volts DC • Minimum set and reset power 180mW • Nominal set and reset power 360mW Specifications Contact • Max switching power 60W, 125VA • Max switching power 220V DC, 250V AC • Max switching current 2A AC/DC • Max carrying current 3A AC/DC • Size 20x10x 10(H)mm

Cat. SY-4060 **$9.95**

Mini Glue Gun

240V Operated Cat. TH-1990

Was $14.95 Save $4.95

September $10

DESOLDERWICK!

Cat. NS-3020 **Normally $2.75**

September $1 Roll

Limit - 5 per customer

20 MT. ROLL OF MONITOR OFC SPEAKER CABLE NEW

Save 75c per mt. over buying from a big reel. Supplied on a plastic reel.

Cat. WB-1736 **Only $69.00**

RESPONSE PROFESSIONAL MIC CABLE

The best quality microphone cable for all P.A. and stage use. Super flexible black matt finish PVC low noise cable with tinned copper shielding.

2 CORE SHIELDED

Cat WB-1530 Specs: 24/0.20 x 2 core + 112/0.12 NEW

Colour: red & white conductors. Outer dia: 6.5mm

$2.20 / metre or $150 / 100 metre roll

4 CORE SHIELDED

Cat WB-1540 Specs: 11/0.20 x 4 core + 112/0.12 NEW

Colour: red,white,yellow & black. Outer dia: 6.2mm

$2.75 / metre or $192 / 100 metre roll

NEW JAYCAR STORE IN BRISBANE

1322 GYMPIE ROAD. CNR ALBANY CREEK RD. ASPLEY QUEENSLAND

Phone: 3863 0099 Phone/Fax: 3863 0182

NOKIA 100 NI-MH 1200MAH BATTERY

Standby 30 hours, Talktime 130 min.

Cat. SB-2551 Was $49.95

September $39.95 Save $10

MOTOROLA MICROTAC SLIM

900mAh Ni-Mh. 12mm thick. Standby 20 hour, talktime 85 min. Cat. SB-2569

Was $79.95

September $65 Save $14.95

LASER POINTERS

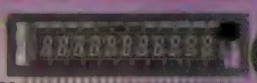
Cat. ST-3100 **$39**

KEYRING **SAVE**

Cat. ST-3102 **$45**

11 DIGIT FLUORO BARGAIN

Vacuum fluorescent displays - still look the best.



Once again Jaycar has purchased a substantial quantity of a quality Futaba brand vacuum fluorescent displays. Each digit measures 6.0mm(H) x 3.5mm(W), 11 digits in all. The display also features an apostrophe in the top right hand corner of the digits, and a semicolon (;) in the bottom in all 11 digits. Electrical and mechanical data is incl in the price. Cat. ZD-1880

Only $4.95ea / 10 up $4.40

Not to forget! Allegro brand UDN6118A Driver IC

Cat. ZD-1882 **Only $4.95 10 up $4.40**

ETHERNET NETWORK CABLES - BNC

Supplied with a BNC plug on each end.

2 metres Cat. PL-0939

ONLY $6.95

5 m Cat. PL-0938

ONLY $9.95

10 m Cat. PL-0937 **ONLY $16.95**

EXTREMELY LARGE LCD DIGITAL CLOCK WITH CALENDAR AND TEMPERATURE NEW

This must be the largest LCD clock we have ever seen! Ideal for warehouses, factories, offices and home etc. Includes: •temperature readout in C or F •calendar with day, date and month display •12 or 24 hour time •huge 152 x 94 LCD display with actual time digits 55mm high •total size 210(w) x 230(h) x 25(d)mm. Charcoal in colour. Operates from 2 x AA batteries.

Cat. XC-0230 **Only $79.95**

BUY 10 LESS 10%

COAX CRIMPING TOOL KIT

See Cat. page 105 for full details. The kit includes: •One crimper with 5 interchangeable crimping dies •One cable cutter, 6.5" long with curved blade •One rotary coax cable stripper. •Screwdriver for changing dies •Plastic carry case which houses all.

Cat. TH-1878 Was $149.50

September $129.50 Save $20

CCD MINI CAMERA

This mini camera comes in a black metal case that measures only 35(W) x 35(H) x 15(D)mm!! Unbelievably small. Supplied with mounting bracket and lead with DC socket and BNC socket. Requires 12VDC, & connects to any standard video input - like your VCR, or via an RF modulator to a TV aerial

NEW

Cat. QC-3470 **Only $149.50** SAVE $10

NEW

CCD BOARD CAMERA

Cat. QC-3460 **$125** SAVE $14.50

LOOKS LIKE A PIR CAMERA!

Includes infra red LEDs for night illumination. Cat. QC-3450

$159.50 SAVE $10

UHF/VHF FRINGE BARGAIN ANTENNA

NEW

The big brother to our best selling antenna. Its bigger and is ideal for using in fringe area locations. Receives UHF channels 28 to 36 (band 4) and VHF channels 0-11. This antenna is $50 less than the brand name equivalent. Boom length 2mts., 7 x VHF elements, 12 UHF elements and includes 75Ω balun to run coax. Please note that the big VHF elements are 1.3mts. long, so if you live in an area that very large birds frequent, beware! Cat. LT-3142

AMAZING PRICE! Only $79.95

REMOVEABLE HARD DISC CARRIER + FRAME

NEW

Ever wanted to transport large amounts of information without using a Zip Drive or a CD ROM writer. Now you can without breaking the bank. Use any type of 3.5" or 2.5" hard disk between two PC's e.g. home & work. Quality made unit •Lockable cradle •Power LED + HDD usage LED •Fits a standard drive bay

IDE KIT Cat. XC-4670

SCSI KIT Cat. XC-4671 **$39.95ea**

CANCER FROM MOBILE PHONES WHY TAKE THE RISK?

NEW

There has been much talk lately about the Electromagnetic radiation effects of mobile phones on your head. It seems that some university tests have established a link between 800MHz (mobile phone frequency) radiation and cancer in laboratory rats. Whether this alleged link is applicable to humans is yet to be established. Anecdotal evidence, however, seems to indicate that frequently used mobile phones give many people up to severe headaches, disorientation etc. Jaycar has been searching the world for over 6 months now to find a suitable RF (Faraday) shield to protect the head from radiation yet not compromise the performance of the phone itself.

At last we have come up with a product that does this. The area of greatest radiation concern is around the base of the antenna and around the earpiece ie. where your ear actually presses against the phone. Our product consists of a quality leather case custom made for most popular phones with a LEAD SHIELD sewn into the antenna base/loading coil area and right across the earpiece area. When you put the case over your phone you fashion the cloth protected extremely malleable lead shield around the antenna base. You can test the effectiveness with a meter type microwave oven leakage detector. The difference from unprotected to protected is amazing, yet the signal strength meter on your phone display will show the same levels of signal as an unprotected phone.

The Jaycar PHONE GUARD protector costs no more than a standard replacement leather case and gives you the comfort of reducing the direct radiation into your head which could be extremely harmful!

This superbly designed case also includes a ROTATABLE BELT CLIP, which easily allows you to turn your phone to the horizontal position, allowing you to sit down comfortably.

Lead shield shown opened. Shield is simply wrapped around the antenna base.

Microtac	Cat. HC-6920	**Nokia 1610**	Cat. HC-6932
Motorola 8200,8400	Cat. HC-6922	**Nokia 8110**	Cat. HC-6934
Motorola Flare	Cat. HC-6924	**Ericsson 318/388**	Cat. HC-6938
Motorola 8500,8700	Cat. HC-6926	**Ericsson 738/788**	Cat. HC-6940
Nokia 2110	Cat. HC-6930		

Only $39.95 each

5 AMP NOISE SUPPRESSOR NEW

Only **$12.95**

Easy to use noise suppressor for car stereos. Connects in power lead before stereo. Features gold plated terminals and housed in round plastic case. Three wire connection. Due early September. Cat. AA-3050

SCOOP PURCHASE OF THE DECADE

AURA INTERACTOR

Plug it into computer games, stereos etc, then put the back pack on and feel all the low frequency sounds. See previous ads for full details. Cat.XC-1000

SAVE $200!

WAS $249

NOW ONLY $49.95

COMPUTER BATTERY - 3.6V LITHIUM

As used in most PC's. Supplied with PC mount Pins.
- Storage period - 10 years.
- Dimensions - 25(W) x 14(Dia)mm.

Cat. SB-2540 **$9.95**

TWO WAY SPEAKER SELECTOR

This product is housed in a quality anti-hum metal case, and allows 2 pairs of speakers to be run from an amp with only one set of outputs. Listen to either pair of speakers separately or both on together. Cat: AC-1640

Was $29.95 Sept. $19.95 Save $10

DELUXE KNIFE SET & MITRE BOX

The knife set includes three different sized handles and 21 assorted blades. The mitre box is made from aluminium and is 138mm long. The saw blade length is 126mm. A block sander is included, along with a scriber, tweezers & a small wooden wedge. Cat. HG-9945

SAVE $10

Was $29.95 Sept $19.95

LCD TEMPERATURE MODULE WITH ALARM FUNCTION

These LCD temperature modules are designed to be panel mounted and run from an AA battery. They have a temperature probe on a cable approx 550mm long. The temperature can be preset (both high and low) and when that temperature is reached, an alarm output of 2kHz is triggered for 1 minute (buzzer not included) and an output pin goes high for at least 1 minute. A LED or pilot lamp can also be connected to flash when the preset temperature is reached. See catalogue page 173 for full specs. Limited quantity available.

Cat. QM-7220 **$24.95**

NTSC TO PAL CONVERTER KIT

The Jaycar kit includes the NTSC - PAL module, high quality Japanese RF modulator, punched and silk screened front and rear panels, PCB plus all specified electronic components. 12 VAC plugpack required use MP-3020 $16.95

Cat. KC-5223

Was $149.50 Sept $120 Save $29.50

COMBINED SIREN & STROBE

Incorporates 2 piezo screamers giving 120 dB, and two Philips brand globes which strobe. See Cat. page 68 for full details. Cat. LA-5308

Was $29.95 Sept $19.95 Save $10

HIGH CURRENT POWER CABLE

The current stock we have is not quite up to full 4G and 8G specs. Its slightly smaller, but will still do the job perfectly in 99% of installations. Your chance to save !!

SAVE

8GA POWER CABLE

Normally $2.95 mt. / $220 100mt. roll.

Now $1.95 mt. / $170 100 mt. roll.

RED Cat. WH-3060

BLACK Cat. WH-3062

4GA POWER CABLE

Normally $7.95 mt. / $325 50mt. roll.

Now $5.50 mt. / $225 50 mt. roll.

RED Cat. WH-3064
BLACK Cat. WH-3066

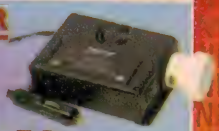
SAVE ON 3.5 DIGIT PANEL METERS

See Catalogue page 24 for full details & specs.

LCD QP-5550
Was $19.95
Sept $14.95
Save $5.00

LED QP-5555
Was $24.95
Sept $19.95
Save $5.00

200 WATT INVERTER



12VDC TO 230VDC INVERTER Cat. MI-5038

Was $159.50 Save $30

September $129.50

NEW POWER SUPPLIES

Save $20 on each model.

12VDC 2AMP REGULATED
Cat. MP-3017 NEW
Was $69.95 **Now $49.95**

13.8VDC 2AMP UNREGULATED NEW
Cat. MP-3018
Was $59.95 **Now $39.95**

THE "FULL HOUSE" POWER DRIVER BIT SET

All the weirdo driver bits in one go!! -The set consists of 32, of the driver bits that you don't normally see. You don't get any slotted, Phillips or Posidrive bits. You do get: •4 x Tri - wing, size 1, 2, 3, and 4 •9 x Torx (tamperproof), size T8, T10, T15, T20, T25, T27, T30 and T35 •4 x Pin drive (snake), size 4, 6, 8 and10 •6 x In - Hex (allen), *metric, size 2, 2.5, 3, 4, 5 and 6 •6 x In - Hex (allen), *imperial size 5/64", 3/32", 7/64", 1/8", 9/64" and 5/32" •3 x Torque Set, size 8, 9 and 10. With this you get a hex driver with magnetic retainer, all in a nifty plasticy - rubber holder that is smaller than a deck of cards! (67 x 45 x 30mm). you will never get stopped by a wacko screw ever again!! Save $8.00

Cat. TD-2035

Was $29.95 ONLY $21.95

PRECISION 5" BOX CUTTERS

Cat. TH-1886
Were $19.95
NOW $14.95
Save $5.00

PRECISION 5" LONG NOSE PLIERS

Cat. TH-1888
Were $19.95
NOW $14.95 *Save $5.00*

STOP PRESS! SENSATIONAL DEALS ON STEPPER MOTORS

Jaycar has made a last minute scoop purchase of brand new stepper motors. To make this ad deadline we had no time to provide further details. by the time you read this, however, we will be able to tell you the whole story. Call in to any store or ring us if you are in the market for stepping motors.!!!

INDUCTANCE DMM

Includes: •Capacitance •Temperature •Transistor test •Continuity buzzer •Diode test •Holster •Carry bag. See 97 Cat. page 21 for full details.Cat. QM-1480

Only $99.50

DWELL TACHO DMM

•RPM X 1, X10 •Dwell angle •Resistance •DC volt •Holster included •Great price!! See 97 Cat. page 22 for full details. Cat. QM-1440

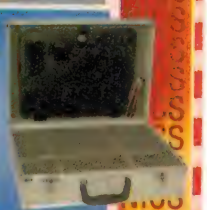
Only $69.95

ECONOMY ALUMINIUM ATTACHE CASE

With tool pallet for lid & 5 adjustable dividers. see cat page 95 Cat. HB-6352

Was $62.50 Save $20

Sept $42.50



MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

RESPONSE CAR AMPLIFIERS

Two brand new Taiwan made Hi quality car amplifiers from Jaycar. 100WRMS x 2 & 50WRMS x 4.

Features for both: •Mosfet power supply •Built in hi-low pass electronic crossover •Digital pulse-width-modulated power supply •Bridgeable to mono operation •High level inputs •Gold plated RCA low level inputs •Low level gain control •Low pass-flat-hi pass switch control •Remote soft turn on control •Power on LED indicator •Gold plated terminals •Externally mounted ATC power fuse •Low overall negative feedback •Direct coupled output stage •4 way protections: thermal, current, DC offset and overvoltage.

SPECIFICATIONS:	100W RMS X 2	50W RMS X 4
WRMS per channel 4Ω	100 x 2	50 x 4
WRMS per channel 2Ω	150 x 2	80 x 4
WRMS bridged output 4Ω	180 x 1	100 x 2
S/N ratio	90dB	75dB
Total harmonic distortion	<0.08%	<0.06%
Frequency response	15Hz - 45kHz	15Hz - 35kHz
Hi pass frequency	50Hz - 500Hz	50Hz - 500Hz
Low pass frequency	50Hz - 250Hz	50Hz - 250Hz

100WRMS X 2 NEW **$229** Cat. AA-0432

50WRMS X 4 NEW **$319** Cat. AA-0438

MOTOROLA MICROTAC LI-ION BATTERY NEW

Lithium Ion batteries give you much better talk time and are environmentally friendly. This battery has a current capacity of 1.35 amp. When used with a 8400/8700 Motorola you get 120 hours standby & 540 mins talktime, and with a Microtac you get 40 hour standby and 180 mins talktime - and no memory effect. And at Jaycar pay no more. These sell for between $189 & $250 at our opposition.

Cat. SB-2572 **$139.50**

Jaytech 0-30 Volt DC 2.5 Amp Variable Laboratory Power Supply

This Lab Power Supply features:
- VARIABLE OUTPUT VOLTAGE 0 TO 30 VOLTS
- VARIABLE CURRENT LIMITING 0 TO 2.5 AMP
- FIXED 5 VOLT AND 12 VOLT OUTPUT AT 500MA
- SEPARATE VOLTAGE AND CURRENT METERS

Cat. MP-3080 **Was $179.50**

Save $20 Sept $159.50

PLUG PACK BARGAIN

12VDC 1 AMP with 7 plugs as pictured.

Cat. MP-3015

Was $22.95 Save $8

Sept $14.95

WORLD TRANSISTOR COMPARISON TABLES

VOLUME 1 Cat. BM-4584

VOLUME 2 Cat. BM-4585

1996 Price $19.95 Now $9.95ea

SAVE $$$ ON VERO TYPE BOARD

Alpha numeric grid, pre-drilled 0.9mm, 2.5mm spacing. 95mm wide x 3 handy lengths

	WAS	SEPT	SAVE
95 x 76mm Cat. HP-9540	$2.95	$1.50	$1.45
95 x 152mm Cat. HP-9542	$4.25	$2.25	$2.00
95 x 303mm Cat. HP-9544	$7.50	$4.50	$3.00

Light Dependant Resistors

See catalogue page 143 for full specifications.

Cat. RD-3480
Dark resistance: min 10MΩ
Light resistance: 30 - 300Ω
Was $2.50
Save $1.00
Sept $1.50

Cat. RD-3485
Dark resistance: min 0.5MΩ
Light resistance: 2.8K - 8.4KΩ
Was $3.95
Save $1.00
Sept $2.95

SCREECHER CAR ALARM KIT

Goes off "inside" the car! See catalogue page 14 for full details. Cat. KA-1675

Was $39.95
Save $15.00
Now $24.95

High Energy Ignition Kit

See catalogue page 13. Refer Silicon Chip June 88. Cat. KC-5030

Was $55
Save $6 Now $49

TURN YOUR SURPLUS STOCK INTO CASH!!!

CALL MARK OSTRO OR BRUCE ROUTLEY NOW ON (02) 743 5222

Dolby Pro Logic Kit.

Build your own genuine Dolby kit. See catalogue page 4 for full details. Cat. KC-5175/6

Was $199.50
Sept $169.50 Save $30

HIGH QUALITY STEREO EARPHONE

Ultra lightweight mini phones. Metal grille. Supplied with 2 spare ear pads. Drive Unit 13.7mm dia Mylar speaker Cat. AA-2015

Was $8.50

SEPTEMBER - NOW ONLY $4.50

Jaycar ELECTRONICS

HEAD OFFICE
8-10 LEEDS ST RHODES 2138
PHONE: (02) 9743 5222
FAX: (02) 9743 2066

Quality System — Quality Endorsed Company ISO9002 Lic 6143 Standards Australia

WHOLESALE
PHONE: (02) 9743 5222
ORDERS: 1800 620 169
FAX: (02) 9743 3070
FREEFAX: 1800 810 137

MAIL ORDERS FREE POST TO:
Reply Paid 72. Jaycar Mail Orders. PO Box 185 Concord NSW 2137 FREE CALL FOR ORDERS: 1800 022 888
ENQUIRY HOTLINE: (02) 9743 6144 FAX: (02) 9743 2066

ROAD FREIGHT ANYWHERE IN AUST (up to 20kg) $14.00

POST & PACKING $10 to $24.99=$4.00 $25 to $49.99=$5 $50 to $99.99=$7 OVER $100=$8

ADELAIDE SA •194 Wright St (Cnr. Selby St) •Ph:(08) 8231 7355 •Fax:(08) 8231 7314 •Mon/Fri:9-5.30 •Fri:9-8.30 •Sat:9-4

BURANDA QLD •144 Logan Rd •Ph:(07) 3393 0777 •Fax:(07) 3393 0045 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4

ASPLEY QLD •1322 Gympie Rd, cnr Albany Creek Rd •Ph:(07) 3863 0099 •Fax:(07) 3863 0182 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4

CANBERRA ACT •Shop 2, 11-13 Kembla St. Fyshwick •Ph:(06) 239 1801 •Fax:(06) 239 1821 •Mon/Fri:9-5.30 •Sat:9-4

MELBOURNE CITY •Shop 2,45 A'Beckett St•Ph:(03) 9663 2030•Fax:9663 1198 •Mon/Fri:8.30-5.30 •Fri:8.30-5.30 •Sat:9-4 •Sun:10-4

COBURG VIC •266 Sydney Rd •Ph:(03) 9384 1811 •Fax:(03) 9384 0061 •Mon/Fri:9-5.30pm •Fri:9-8.30 •Sat:9-4 •Sun:10-4

SPRINGVALE VIC •887-889 Springvale Rd Mulgrave. Nr Cnr. Dandenong Rd •Ph:(03) 9547 1022 •Fax:(03) 9547 1046 •Mon/Fri:8.30-5.30 •Fri:8.30-8.30 •Sat:9-4 •Sun:10-4

HOBART TAS •140 Campbell St. Hobart •Ph: (03) 6231 5877 •Fax:(03)6231 5876•Mon/Thur:9-5.30•Fri:9-8.30•Sat:9-4

SYDNEY CITY •129 York St •Ph:(02) 9267 1614 •Fax:(02) 9267 1951 •Mon/Fri:8.30-6 •Thurs:8.30-8.30 •Sat:9-4 •Sun:10-4

BANKSTOWN •363 Hume Hwy Cnr Meredith•Ph:(02) 9709 2822•Fax:(02)9709 2007 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4 •Sun:10-4

GORE HILL •188 Pacific Hwy Cnr. Bellevue Ave •Ph:(02) 9439 4799•Fax:(02)9439 4895•Mon/Fri:9-5.30•Thurs:8.30•Sat:9-4•Sun:10-4

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Project follow-up:

SOFTWARE FOR THE REMOTE POWER-UP

In the June issue we described how to build, setup and use our phone-controlled remote power switch, and indicated that in the next instalment we'd take a look at software that can be used with the Power-up. As promised, here we discuss how to use DOS-based communications software and our home-grown utility programs to best effect with the Remote Power-up, plus more...

by ROB EVANS

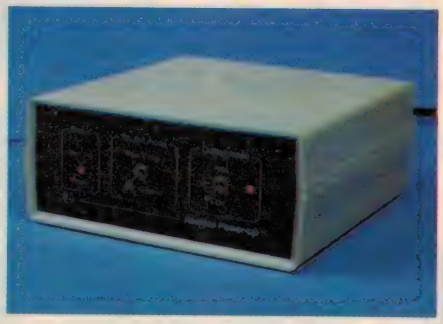
For those that may have missed the Remote Power-up construction project presented in the June issue, in that article we described how this low-cost project can be used to remotely switch on 240V AC appliances, or more significantly, how it can make remote access computer software a much more viable proposition.

In this latter application, the Power-up is used to switch on a 'host' PC from a remote location — by letting the phone line ring a predetermined number of times then hanging up — and this in turn automatically runs your chosen host communications software. A remote comms session can then take place, and the Power-up will ultimately turn the PC off again after that comms session has ended. In this way the remote computer is normally powered down in a safe and secure state, and is only powered up when actually needed.

To establish say home-to-office or office-to-home links in this manner though, you will need a suitable remote access program as well as the Power-up box itself. Ideally this should be of the *callback* type (as discussed in the previous article), should offer a useful range of file transfer facilities, and provide a password security system. Here we'll discuss a number of comms programs that are available for downloading from the EA BBS — phone (02) 9353 0627 — including one written specifically for the job (see CALLBACK), plus a couple of utilities that will help you set up and use the Power-up in the most effective way.

RINGTEST.EXE

The utility program RINGTEST.EXE was written here at EA, and is designed to help with the job of configuring the Power-up's delay setting (DSW1). While this delay can be set on a trial-and-error basis as mentioned in the June



'97 article, RINGTEST should make this job rather easier.

This program simply monitors the activity on the PC's serial port and measures the duration of pulses appearing at the Ring Indicator handshaking line, which is in turn driven by the modem in response to ring signals on the phone line. When you run RINGTEST it first asks you to nominate which COM port (1 or 2) the modem is connected to; then when a call arrives, it stores and displays the pulse width (in seconds) of each successive ring pulse on the RI line. It then uses this information to estimate a suitable delay setting for DSW1 in the Power-up.

In practice this means that you will need to get someone to call your number and let the line ring an agreed number of times (say five), so that you can let RINGTEST 'assess' how your modem toggles the RI line and then suggest the best way to setup your Power-up. We would recommend that you repeat this test a few times by the way, so you can check that RINGTEST delivers the same suggestions for each (unanswered) call...

To briefly recap on the need to have an adjustable delay in the Power-up (as set by DSW1), we need to look at the relationship between how many rings the caller hears and how the remote modem's RI line ultimately responds to these. With most modems the RI line will usually provide one more pulse than the caller hears, and this extra pulse can be either quite short or (less often) around the same length as other 'valid' pulses — it all depends on the modem itself.

If the modem is of the type that delivers a brief extra pulse, the Power-up's delay (or hold-off, if you like) can be set to reject this and any shorter pulses. The Power-up's circuit will therefore accurately count the number of rings that the caller heard, and respond accordingly.

A typical example of this might be that the modem delivers a 0.3-second pulse as the first 'false' ring, and one-second pulses for the remaining rings. A delay setting of 0.64 or 0.8 seconds would be suitable here, since shorter pulses (0.3s in this case) will be rejected and normal ring pulses (lasting one second) will pass to the counting circuit. Note that the short pulse can appear at the start or end of the ring pulse train (but never both) and sometimes may not appear at all. In all of these cases though, the delay circuit will pass the correct number of rings.

A less common situation is where the modem delivers one extra *full-length* pulse, and the delay circuit cannot help since all pulses are of about the same duration. In our practical example then, the five-ring test calls might produce six one-second (or thereabouts) pulses, and the delay can't be set to reliably distinguish the 'false' ring — it should therefore be adjusted to some nominal time that's less than one second (say, with DSW1 set for a delay of 0.64 seconds) so that all pulses are passed.

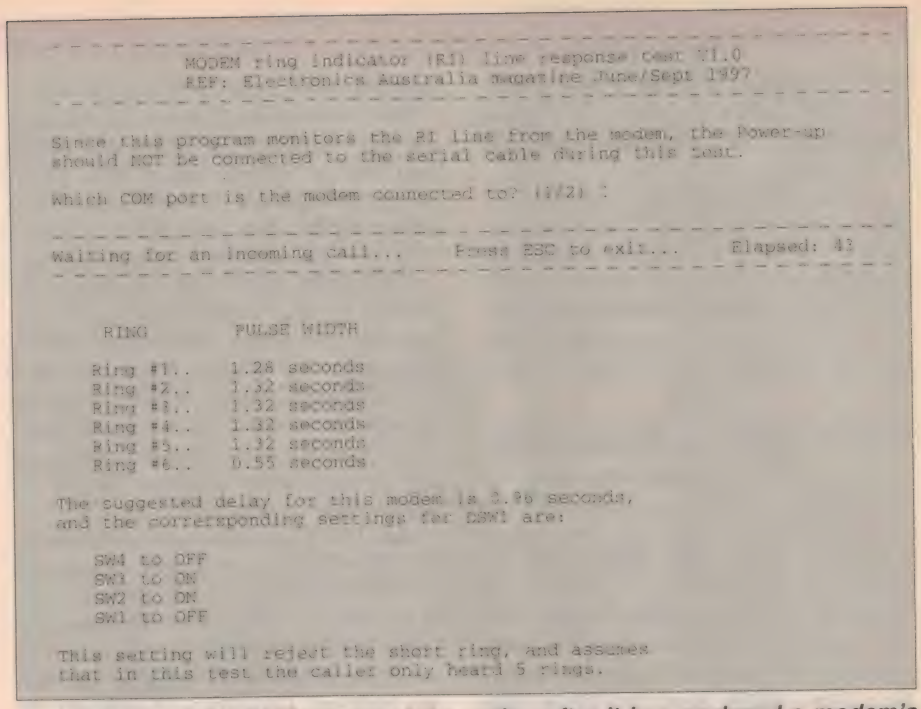
The answer in this case of course, is to set the Power-up's 'number of rings' setting (DSW2) to one *more* than is required. So if you ultimately want the Power-up to switch on its 240V outlet

when say *three* rings occur, you will need to set DSW2 to detect *four* ring pulses.

As it happens though, all of these considerations are taken into account in our RINGTEST program, and this will take note of the pulse width trend in the received ring pulses. RINGTEST therefore takes a reasonable stab at what an appropriate delay setting would be in all cases, and when appropriate offers suggestions along the lines discussed above.

A last point regarding RINGTEST is that it has a limited ability to asses the best Power-up settings when the stream of ring pulses don't have a typical format. If there are *two* very short pulses for example, the program will probably suggest an inappropriate delay setting, and you are best off judging that for yourself. Since RINGTEST sequentially displays the time duration for each pulse, you can easily check the validity of its suggestions.

And finally, a further advantage of using a *callback* type of host program with the Power-up is that you quickly know if you initial setup call has been detected correctly, since the remote system then turns on and calls you back. If the Power-up's 'number of rings' detection ends up being a little unreliable due to problems mentioned above, it will be quite obvious if a setup call didn't trigger the remote system, since it just won't call you back. In this case simply wait for a minute or so, and try again...



A sample of RINGTEST's screen information after it has analysed a modem's response to six rings of an unanswered call. As you can see, the program has suggested a delay setting of 0.96 seconds so that the Power-up will reject the false short ring pulse (Ring #6).

SWITCH.EXE

The other utility program we've developed to help you use the Power-up is SWITCH.EXE, a small executable that redirects program flow as a PC boots up. If SWITCH.EXE is called in the machine's AUTOEXEC.BAT file, it will note if the Power-up has activated the system and divert the start-up procedure to your nominated remote-access (host) software. On the other hand, if the PC has been manually switched on in the normal way, SWITCH effectively takes no action and allows the machine to boot up normally.

This little utility program works in a very simple way, and simply takes advantage of the signal fed back from the Power-up to the PC on the serial cable's Ring Indicator (RI) handshaking line. You may recall that the Power-up breaks the RI line between the modem and the PC's serial port, and while it monitors the line from the modem (to detect incoming ring pulses), it actually takes control of the RI signal sent back to the PC. In short, if the Power-up's 240V outlet has been activated remotely (by the correct number of rings) the RI line at the PC's port will be driven to a high level.

SWITCH just quickly checks the state of the RI handshaking line on the machine's COM ports — then as it terminates, delivers a DOS error level indicating what it found. As this will be error level 22 when the RI line at either COM port is high and level 11 if both are low, it's a simple job to include SWITCH in the AUTOEXEC.BAT file and use the resulting error level to direct the boot-up procedure. A typical way to include these commands would be:

```
CD\QMODEM
SWITCH.EXE
IF ERRORLEVEL 22 QMODEM.EXE
CD\
```

Here, DOS is told to change to the QMODEM directory, run the SWITCH utility, and if the resulting error level is 22 run the comms software QMODEM — see later for information on QMODEM and other suitable comms programs. If SWITCH has not delivered an error level of 22 (or 11 in practice), DOS is instructed to simply change back to the root directory (CD\) and move on — so in effect, no action is taken when RI is low during a normal power-up sequence.

The are a couple of important aspects to note when using this setup however. Firstly, you should change to the comms program's directory before it is run (as in our example), so that the software can find all of its associated configuration and support files — this means that SWITCH.EXE should also be located in that directory.

Secondly, the above instructions must be positioned in the AUTOEXEC.BAT listing *before* any software that takes over the system, such as DOS-based shell programs (Norton Commander, Dosshell, etc) or Windows. As this is usually the last command in AUTOEXEC.BAT (say, WIN), it should be fine to put your version of the four instruction lines just before (that is, above) that line.

Other than that, the commands associated with switch can be put at almost any point in AUTOEXEC.BAT without any real problems, provided they are grouped together. Just remember that whatever is after those commands will not be loaded or run when the Power-up has activated the system. In fact this can be used to advantage since for example, you can block access to networked drives by putting the four lines before any network drivers are loaded.

It's also important to arrange your remote access software so that it does not drop back to DOS when you have terminated your remote session — or have 'logged off' in effect. This is because the system would then proceed to run the remaining lines in your AUTOEXEC.BAT, such as loading Windows, and the process may be interrupted when the Power-up finally shuts off power to the system. At worst this can lead to hard disk problems

such as unterminated files (lost allocation units), and at best a following 'incomplete boot' message during the next startup.

In our experience though, comms programs will not exit to DOS when running in their 'host' mode, since they normally just reset and await the next call. Thanks to this suspended or quiescent state, the Power-up can safely shut off the system power at the end of a remote comms session.

SWITCH.EXE & Windows95

While some uncharitably refer to Windows as 'DOS in a clown suit', the association with DOS has been taken somewhat further with Windows95. Its version of DOS (version 7) is far more integrated with the main GUI than was the case with Windows 3.1 and its variants, and as most Win95 users are aware, the system simply boots up directly into Windows with no sign of a DOS cursor.

As a result, there usually isn't an AUTOEXEC.BAT or CONFIG.SYS to contend with, and all of the system configuration jobs are done in Windows itself. Win95 *will* take notice of an AUTOEXEC.BAT file however, and on some occasions actually creates one for its own use during DOS-based applications — it's just that it normally doesn't need it...

To make a Win95-based system boot up in a particular way at a DOS level then, we can simply create an AUTOEXEC.BAT file and include the four command lines mentioned above. On the other hand if an AUTOEXEC.BAT does already exist for some reason, the commands can just be inserted into the file in the normal way.

We recommend that you edit or create the AUTOEXEC.BAT file while you are in Win95 rather than DOS, using Wordpad or a similar plain-text editor. In this way you can be sure that you are not working on a temporary AUTOEXEC.BAT file created by Win95 for that DOS session, and any new file you create will be regarded as permanent by Win95. Note that in a Win95-based system, Windows can be thought of as the core or natural operating environment rather than DOS, so any configuration changes should be made while in that mode.

Once SWITCH.EXE and its associated command lines have been included in an AUTOEXEC.BAT file, you may like to temporarily add a PAUSE command (after SWITCH.EXE) so that you can see if the batch file is doing its job during boot-up. PAUSE will suspend the process while waiting for a keystroke, and this will allow you to check the screen message delivered by SWITCH as it runs — otherwise, the message just flashes past during the rapid boot process. Don't forget to remove the PAUSE statement when you are satisfied that the system is both recognising and running your AUTOEXEC.BAT.

And lastly, we should reinforce the point that whatever DOS-based host terminal software you elect to run, it should not drop back to the operating system when a remote comms session ends. This is particularly important with a Win95-based setup since the system will then immediately run Windows, and the startup process may be interrupted as the power is shut off by the Power-up — Win95 would then report an incomplete boot error at the next startup.

All in all though, with the help of our RINGTEST and SWITCH programs you should find it quite easy to use the Power-up with a wide range of host and remote access software, and the machine's 'platform' (Win95 or otherwise) won't present any real obstacles.

While there's no shortage of programs that are suitable for the task, we've found the following examples of low-cost software work well.

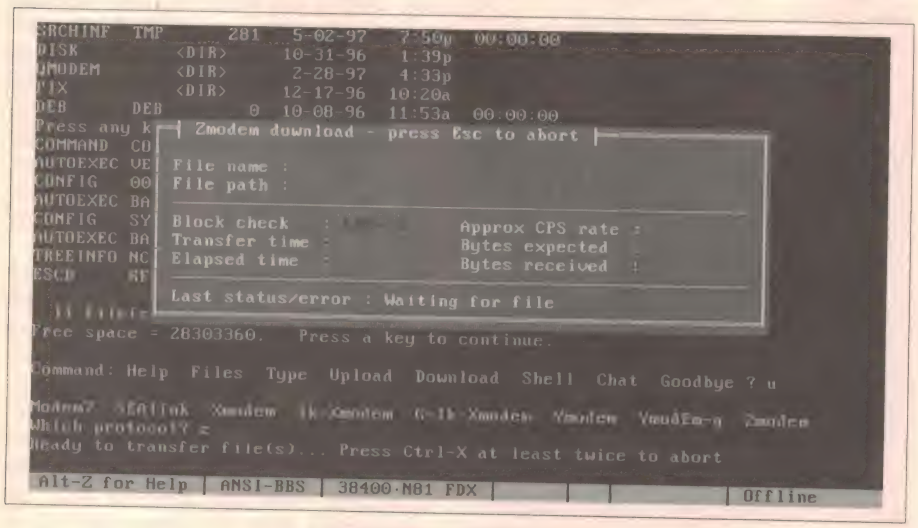
QMODEM

The communications software package QMODEM V4.51 is available from the EA bulletin board by downloading QM452TD1.EXE and QM452TD2.EXE from the 'Useful Utilities' file area (number 110). While QMODEM is a very comprehensive DOS-based terminal program that could be used for all of your conventional data comms needs, it has a built-in *callback* feature that may be of particular interest to those using the Remote Power-up unit.

With the callback feature enabled QMODEM will simply answer all incoming calls, then prompt the caller for a name and password. If that entered information matches a name/password combination on a predefined list, the program then hangs up and dials the phone number which corresponds to that name on the list — it literally calls you back...

The idea here is that you (the 'caller' in this case) then use your modem to answer the next incoming call, and a remote communications session will be established with QMODEM acting as a host program at the remote end. Note that this all assumes that you have entered your name/password details correctly, and you are indeed calling from the number that's entered alongside your name on QMODEM's callback list. If the name/password information does *not* match any of those on the QMODEM's list, the software will simply hang-up and wait for the next call.

This type of callback feature will be mainly of use where a remote system needs to be accessed by several people at different locations, which as you would expect, will correspond to several different (callback) phone numbers. When used with the Remote Power-up, the caller will first need to activate the Power-up in the normal way — calling, then hanging up after (say) three rings — *then* call the system and 'log-on' for the name/password check, as detailed above.



Remote file transfers are quite straightforward when Telix is run with its QDHOST script file. In this screen shot the remote system has just started sending a file.

As you can imagine then this overall arrangement acts as a *very* secure remote access system, since the caller must first know how to activate the Power-up (and hence the remote computer), then supply a valid name and password combination, and finally be located at the phone number corresponding to that name. The cost of this added security is that the system is slightly more complex to operate, and there is an additional phone call involved.

As with other remote access setups that are activated by the Remote Power-up though, casual or unintentional callers are not greeted by modem negotiation tones, and the PC is only on when it is actually needed — this would not be the case for the standard QMODEM callback system.

QMODEM is configured into its callback mode by selecting the setup menu (ALT-N), Host configuration (H), and 'Type of system' (T) as CALLBACK. Also, to be able to access all directories from a remote system you will need to delete the 'Download Dir' path, and the name/password/number details must be added to QMODEM's password file (QMHOST.PWD) with a plain text editor.

And finally, QMODEM can be automatically started in its host mode by using its '/HOST' switch — that is, typing or calling 'QMODEM.EXE /HOST'. The suggested lines to add to your AUTOEXEC.BAT would therefore be:

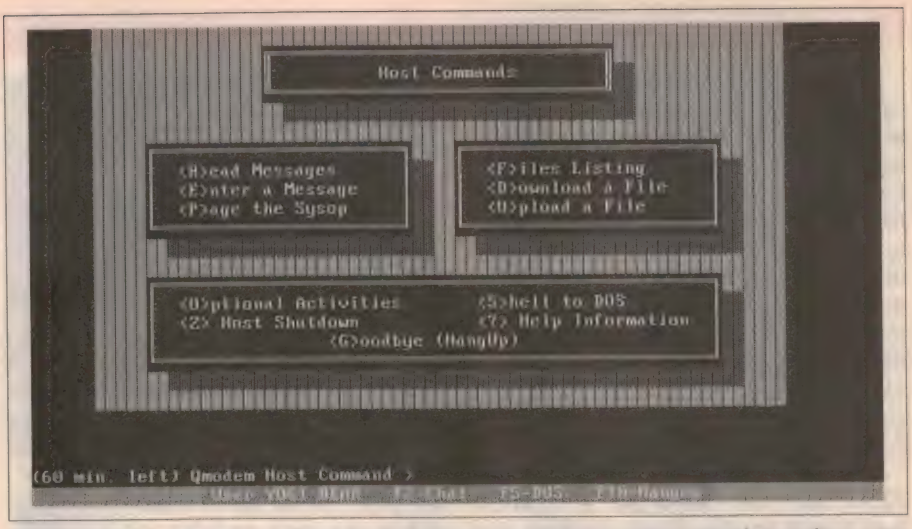
```
CD QMODEM
SWITCH.EXE
IF ERRORLEVEL 22 QMODEM /HOST
CD\
```

TELIX

As with QMODEM, TELIX V3.22 can be downloaded from the 'Useful Utilities' area (110) on the EA BBS, and is a fully-featured DOS-based terminal package with host capabilities — select and download the files TLX322-1.ZIP through to TLX322-4.ZIP.

TELIX's host feature is enabled by loading and running the external 'script' file QDHOST.SLC (Quick and Dirty HOST!), which takes command of TELIX itself, and turns the comms package into quite a useful little host or 'mini BBS' system. So unlike QMODEM with its *built-in* host feature, TELIX is effectively steered by an external script file once it's been loaded using the ALT-G command (go), or when the '/S' command-line switch is used at startup — 'TELIX.EXE /SQDHOST' in this case.

In its normal configuration QDHOST will answer incoming calls, ask for a name and password, then offer the user



The options offered by Qmodem during a remote comms session, when running in its host mode. It behaves rather like a mini BBS, but can be used as a simple file exchange system.

the usual range of options expected of a mini BBS system — downloading, file lists, and so on. For our use though, the trick is to force the setup to act as a callback host program by changing TELIX's 'auto-answer' initialisation string (typically ATA^M) to a *dialing* string — say, ATDT1234567^M if your home or office number is 123 4567.

With this arrangement TELIX (under command of QDHOST) will immediately dial that phone number when it starts, allowing the program to operate as a single-number callback system. So once you have started the remote system via the Power-up in the normal way, TELIX will just call that predefined number.

In practice this system works quite well, with the only quirk being that once you have 'logged off' at the end of your remote comms session, QDHOST will send its auto-answer string to the modem again as the remote system reconfigures itself for the next call. Of course, the remote modem responds to this command and dutifully calls you back, which is rather annoying...

The answer here is to take the phone off the hook (or issue an off-hook command to your modem) immediately after you have disconnected from the remote system, so the remote modem finds the line engaged during this unwanted callback. It then returns a 'BUSY' message, and the system remains in this state until the Power-up eventually shuts off the PC's power due to the lack of carrier signal on the line.

Other software

Of course, there are a numerous other DOS and Windows comms programs that either offer host features, or can be configured in that way. However to take full advantage of the benefits offered by the Power-up (increased security, reduced wear and tear, no caller annoyance, and so on), you really need to be able to configure the software to behave as a automatic *callback* system — that is, to instruct the modem to call a predefined phone number when the program starts.

This callback ability is rarely built into comms programs and you will invariably need to 'fool' the program into behaving this way, as described in the TELIX example above. You may also find that there are some complications with this approach, again as mentioned above, and you may need to further refine the program's configuration or use it in a quite particular way.

So while there is no shortage of software that can do the job, it's invariably more elaborate than is really needed here *and* doesn't do exactly what we want. In the light of this, we decided to take the bull firmly by the horns and have a crack at writing our own callback comms program...

CALLBACK V1.0

The result of this effort is CALLBACK V1.0, a fairly plain-vanilla DOS based host program that dials a predefined phone number at startup, and offers a range of features which are orientated towards remote file exchange. CALLBACK is available for downloading on the EA BBS in the 'EA Project Software' file area (number 140) as CALLBACK.ZIP, and needs a support file contained in the shareware package CEXYZ100.ZIP from the 'Useful Utilities' area (110). Note that CALLBACK.ZIP also contains both the RINGTEST and SWITCH utility programs...

SOFTWARE FOR THE REMOTE POWER-UP

In line with the particular needs of a callback comms program for remote access, CALLBACK offers file uploading and downloading, a full file search facility (not found in other programs), file and directory listing, plus the ability to change to any drive or directory on the remote system. It has the usual password protection system (with a maximum of three tries), will disconnect if there is no activity on the line (after a suitable delay), and can be used with virtually any PC or modem — including those that connect at 28.8kb/s.

You will need to refer to the READ.ME file contained in CALLBACK.ZIP for the details on how the program should be installed, and this will also include details on any recent changes or improvements to the program. It's important to note however that the main executable file (CEXYZ.EXE) from CEXYZ100.ZIP must be located in the *same* directory as CALLBACK.EXE, since the latter uses CEXYZ (a file transfer protocol module) during file uploads and downloads.

Once installed you should find that CALLBACK is just the shot for remote access file exchange, particularly when using the Remote Power-up to activate the system. To keep the file selection tasks simple and fast, the program itself uses a plain text screen based on conventional ASCII characters and makes no attempt to provide a flashy and colourful user interface — plain and functional was the aim...

If you find CALLBACK V1.0 useful or have practical suggestions on how in might be improved, please let us know via the BBS, E-mail, fax or conventional post. While we can't promise an immediate response to your feedback — there's *plenty* to do here at *EA* — we'll take a serious look at any comments as time allows.

The in-line RS-232 interface described (but not shown) in the last article. It just connects in series with the modem-to-PC serial cable, and allows the Power-up to monitor key RS-232 handshaking lines.

Internal modems

Since the Power-up works by monitoring a modem's Ring Indicator handshaking line on the PC-to-modem RS-232 link, it's clearly not compatible with bus-mounted internal modems. As these communicate directly with the PC via its standard I/O bus slot rather than through a conventional serial port, there's no direct access to the handshaking lines needed by the Power-up — we can do without the CD line (by using the 'After 9-rings' shut-off mode), but the RI signal is vital for the Power-up's operation.

With a little ingenuity and a spare (perhaps older) external modem however, the Power-up can theoretically be used with a system based on an internal modem by connecting *both* modems to the line, and just using the external unit to trigger the Power-up. In this case the external modem plays no part in the eventual comms session, and is *only* used to monitor ring signals on the phone line and generate RI pulses for the Power-up.

The only real way this differs from a conventional (external modem only) setup is that your remote access software now talks to the *internal* modem, which then handles all of the dialing and communication jobs in the normal way, while the external modem just acts as a dumb phone line monitor. You will need to use RINGTEST to calibrate the Power-up's delay for the external modem by the way, and you can still successfully use our SWITCH program if you connect a serial cable between the Power-up's RS-232 interface and a spare comms port (1 or 2) on the PC.

We tried out this setup using a retired external 1200b/s modem as the line monitor and found that the arrangement worked well, without any evidence of clashes between the two modems. As the external unit will not answer the phone or attempt communication negotiations unless instructed (or configured) to do so, the old 1200b/s modem in our case just performed its passive role as required.

Unfortunately though, we can't guarantee that this arrangement will work with *your* hardware and internal modem, and it really is just a matter of trying it out. The type of external modem you use for the line monitoring isn't critical; it just needs to have the ability to toggle the RI line in sympathy with ring signals on the phone line. Modems that have an auto-answer feature generally have this capability by the way, and since the unit is not used for communications, its baud rate is irrelevant. ❖

CASSIOPEIA

(Continued from page 27)

the whole the system works very well. As a test I downloaded a small file off the net, and was then able to transfer it to my desktop machine when I had finished the session, all quite painlessly.

As with all the pocket versions of Microsoft software, Pocket Internet Explorer doesn't have all the features of the full version, but it certainly does the job.

Installed as part of Windows CE is Terminal, a small terminal program for non-Internet connections. I tried it out by calling the EA BBS, and found one major problem in that there is no provision for downloading files whatsoever. This was irritating, to say the least. Windows seems to have a reputation for useless terminal programs, and this one seems to be no exception. Perhaps with the growing market for HPC applications, someone will come up with something better in the future.

I should at this point say that the Comport PCMCIA modem that I had been using performed flawlessly throughout. The modem itself is dead cute, and has obviously been designed for the portable computing market as it can easily be connected to a range of digital mobile phones. It comes with a normal PSTN cable that connects the outer end of the PCMCIA card to a standard telephone socket.

I think it would rate as one of the friendliest modems I've encountered, and despite its being made in France, it detected Australian dial, ring, and busy signals correctly.

Conclusion

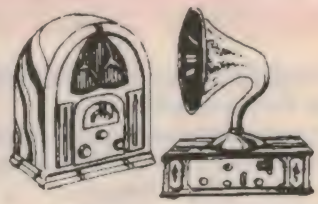
As it stands, the Cassiopeia is a true palmtop computer, and although it relies on a desktop PC to perform printing and software installation, it does hold its own as far as price and portability is concerned.

In using the Cassiopeia for a number of weeks I found that I had very little to say against it. It's a little slow (much like a 386SX33 running Windows), and it would be nice if you could disable the keyboard — as you tend to rest your hand on it while using the stylus. But apart from that I found it quite acceptable.

The large amount of HPC software appearing on the Internet shows that there is a fair degree of confidence in the product from third-party suppliers, and I think it's more than likely that the Cassiopeia will be around for a long time to come. ❖

Vintage Radio

by ROGER JOHNSON



'Super-regenerative' receivers

No discussion of vintage radio would be complete without a reference to super-regeneration. An invention of the redoubtable Major Edwin Armstrong in 1922, the popularity of this circuit was initially both limited and short lived. But it surfaced again briefly after WW2, as we shall see.

In the very early 1920s, when valves were hideously expensive, various means were devised to get the absolute maximum performance from a given valve. One such technique was reflexing (refer Vintage Radio, in the February/March 1997 issues of *EA*) and the other was 'super-regeneration'.

Armstrong's first invention, in 1912, involved taking a small portion of amplified radio frequency signal from the plate circuit of the detector valve, and 'feeding it back', (hence *feedback*) to the tuning circuit. The energy so imparted is in phase with that in the grid (tuning) circuit, and enhances or 're-generates' the signal, such that a larger signal is available to the valve to be amplified. This is the concept of *regeneration*.

By carefully controlling the amount of energy being fed back to the grid circuit, a point can be reached whereby the valve and its associated tuning circuit are operating at maximum efficiency, and hence maximum gain and selectivity. A tad too much feedback, and the valve oscillates. Expressed another way, the optimum condition is when the circuit is on the verge of oscillation.

Those enthusiasts who have operated a simple one or two valve regenerative detector are no doubt well aware of the even greater sensitivity (and therefore gain) that can occur when the detector stage is allowed to self-oscillate. Weak signals are received, but not demodulated. Rather, they present themselves merely as the all too familiar 'squeal'. What if there was some method of maintaining the sensitivity and the gain, but eliminating the self oscillation, and receiving intelligible signals?

Armstrong's invention of 'super-regeneration' in 1922 provided the answer.

If the valve's gain was allowed to build up to its maximum state, and then momentarily suppressed, then allowed to build up to maximum gain before being again momentarily suppressed, and so on, to the point where it always on the verge of oscillation, then the desired results might be achieved. When the valve is at its momentarily low gain state, it takes a finite time to build to its maximum gain state, depending upon the instantaneous input voltage at the grid at the moment of switch on.

What *is* super-regeneration?

Super-regeneration is like an ordinary regenerative detector which is being modulated by a signal at supersonic frequencies — i.e., above the audible hearing range. Hence the name 'super-regenerative'. This modulation is not the speech modulation normally associated with a transmitted intelligible signal. It is a method of gating the valve (although the term was unheard of in 1922!) from its low-gain state to its high-gain state, at a supersonic rate referred to above. At the high-gain state it is on the verge of self oscillation, but is not allowed to remain in that state because at a given point of the gating period, it is switched back to its low-gain state.

In the short time available, dictated by the gating period, the valve cannot reach a sufficiently high enough gain to maintain self-oscillation.

A synopsis of Hikosaburo Ataka's explanation and graphic illustration of super-regeneration taken from *Proceedings of the IRE* (USA) for August 1935 was provided by Neville Williams in 'When I Think Back', in the May 1991 issue of *EA*. A graph and caption from that article is produced in Fig.1.

Mr Williams' article, again referring to Ataka's work, gives a good explanation of a very difficult and complex phenomenon, and also explains the generation of the excessive amounts of noise that characterises super-regenerative detectors. If we refer to the waveform designated 'oscillatory voltage' in Fig.1 as a 'packet', then, quoting Mr Williams, 'In the presence of a weak amplitude modulated input signal, the oscillatory packets are triggered partly by the signal, and partly by the noise, so that the recovered audio is a mix of the two'.

Hence the signal at the anode is a greatly amplified series of packets or bursts of the input signal, corresponding to the gating frequency and amplitude. This gating signal is smoothed by filtering, despite it being at supersonic frequencies, so that intelligible signals

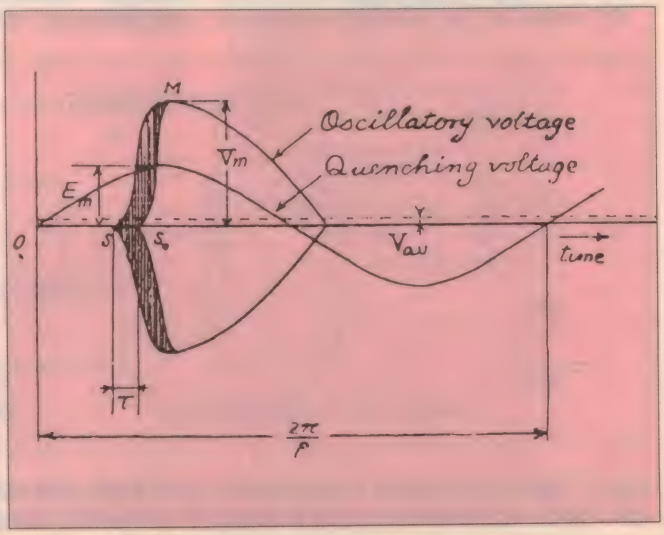


Fig.1: Ataka's diagram showing the essential clue to the operation of a super-regenerative detector. The quench signal initiates and quenches packets of RF oscillation. Extraneous noise and/or signal advances the trigger point (shading), affecting the duration of the burst and superimposing a resulting audio component on the anode current and voltage (dotted line, Vav).

are available either in the headphones or for further amplification.

It may be prudent to add that an alternative name for the gating frequency is the 'quenching' frequency, a term often used in American texts.

How is it achieved?

The gating/quenching may be achieved either by the valve self-oscillating at the supersonic quench frequency, in addition to acting as a normal regenerative stage, or by feeding a supersonic signal to the circuit by separate means involving another valve. The circuits are quite tricky, and understanding them was heavy going for the experimenter of the 1920s!

In the early 1920s there were spark, CW and telegraphy signals, and different circuits were said to favour the reception of the different modes of transmission.

The circuit shown in Fig.2 appeared in *Radio News* for March 1923, and was said to be suitable for spark, telephony or 'ICW' (interrupted continuous wave?) signals — but not suitable for straight CW telegraphy. The text of the article shies away from how it works, instead proclaiming that, 'the manner in which these variations of the regenerative system produce the enormous amplification of the super regenerator are rather complicated and will not be entered into at this time'!

One possible explanation might be as follows. Notice that the negative return of battery B2 is connected in series with a tuned circuit L4/C3, and in the un-earthed grid return circuit is the tuned circuit L3/C2. These coils are of the large honeycomb variety comprising 1500 and 1250 turns respectively, and are magnetically coupled.

By virtue of the cathode current, as opposed to the filament current, flowing through L4/C3, oscillations are established, in the tuned circuit L3/C2. The inductive reactance of the main tuning coil L1 will have little or no effect on L3/C2 as a quenching oscillator. When this circuit swings sufficiently positive to overcome the standing bias, a small amount of grid current will flow for a portion of the gating period, and this dampens entirely the normal regenerative circuit L1/L2/C1 for the corresponding portion of the quenching period. That is, the valve is gated to a low-gain state.

Not shown in the circuit, but explained in the text, is that L1 and L2 are the two coils of a variometer, and L3/L4 are also variably coupled. This is done to enable optimum coupling so that the detector stage is neither shut down completely, because of too much grid current flowing for too greater part of the cycle, nor allowed to oscillate freely because of no grid current flowing at any part of the cycle.

The L1/L2 variometer is one of the normal means of controlling regeneration for maximum effect. For super-regeneration, coupling must be tight.

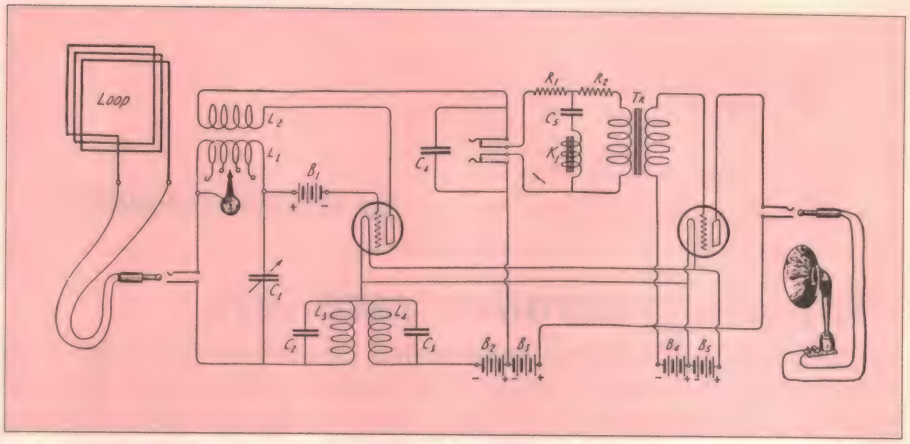


Fig.2: The circuit for the 'Radio Flivver' given in Radio News for March 1923. The RF stage (left valve) is a self-quenching super-regenerative detector.

Explained in the text is the fact that the grid bias may have to be adjusted to 'get it going', then re-adjusted for optimum results. The text gives quite detailed operating procedures, suggesting that there is quite an interplay between the variometer, the quenching circuit and adjusting of the grid bias, in additional to the tuning of a signal.

Quench frequency filter

The second stage of Fig.2 is merely an audio amplifier, with a filter comprising of C5 and inductor K1, which together comprise a series tuned circuit. This presents little or no impedance to the quench frequency.

Quite often the circuit constants were arranged such that a choke of suitable value was used in conjunction with a variable 0.001uF (1nF) capacitor, so that the quench frequency could be literally tuned out.

R1 and R2 are, in all probability, to isolate the inductance of the primary of audio coupling transformer Tr, and hence eliminate any undesirable filtering, loading or detuning effects. The values given are in the order of 10kΩ, large enough to achieve the desired effect whilst minimising any DC resistance of the signal to the primary of the transformer.

Two tube super-regen

For all intents and purposes, the super-regenerative detector in Fig.2 can be regarded as using a single tube (valve). However, in Fig.3, taken from *Radio* for April 1924, a separate tube is used to generate the oscillations, and in this circuit, the output of the quench oscillator is imposed on and added to the anode of the detector tube such that the increased anode voltage increases the stage gain and places it in a super-regenerative state for the desired portion of the quenching cycle.

No mention of valve types appears

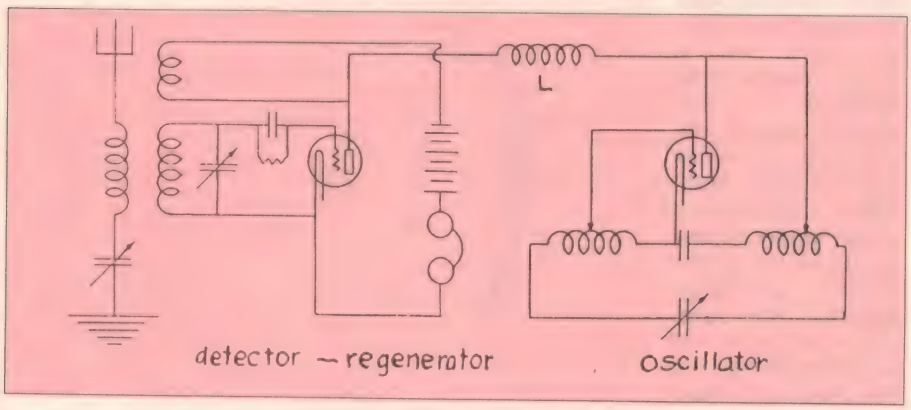


Fig.3: Taken from Radio magazine for April 1924, this circuit shows plate voltage super-regeneration using a separate quenching oscillator.

in the text from which the diagram of Fig.2 was taken, except for a cursory mention of 'five-watt tubes'. This refers to five-watt transmitting types, and it is generally accepted that power types, rather than general purpose types, gave better results. Mind you, in 1923 there were not a huge number of valve types on offer, and a five-watt transmitting type would no doubt cost more than a 'general purpose' type. However power triodes, as such, gave good results. In reality, experimenters of 1923 would have most likely used the bright emitter type UV-201.

Limitations & performance

Quite outstanding results have been claimed for the super-regeneration circuit in terms of sensitivity. Unfortunately, the same cannot be said of selectivity. By the very nature of the super-regenerative process, the tuned circuit (i.e. the grid circuit) is sufficiently dampened to make it more like a feather mattress rather than neatly honed razor (I trust you'll pardon the rather gauche similes).

So in terms of tuning selectivity, super-regens had the reputation of being 'as broad as a barn door'.

For best results, the quenching frequency had to be low in comparison to the tuning range, and if used these days on the normal broadcast band with the station separations of 9kHz, all sorts of difficulties could arise — not the least of which would be heterodyning and cross modulation, and any amount of mixing of quench frequencies with adjacent carriers, sidebands, and so on. However in 1923, those problems did not arise.

A loop antenna was often employed for two reasons: firstly, a large outside antenna was unnecessary; secondly, unless the set was properly adjusted, severe radiation could result and a loop antenna reduced considerably the likelihood of interference to adjacent receivers.

With the quenching oscillator causing generous amounts of noise from within the valve, and possibly inadequate filtering, there was always a nice dose of constant background 'w-h-o-o-s-h' — particularly when tuned off-station. It is also said that unless properly adjusted, high pitched squeals (possibly sub-harmonics of the quench frequency) would be heard in the phones, leading to headaches etc. after prolonged operation!

Who used them?

Because of the inherent difficulty in operation and associated unpleasant noises, commercial manufacturers avoided super-regenerative sets like the plague. This type of set was strictly for the enthusiast. There are no known instances of commercial set manufacturers offering a super-regenerative receiver in their range of models. Experimenters on the 'short waves' — i.e., our current broadcast band — claimed admirable results, such as loudspeaker reception on two valves using only a loop antenna. Such results would have been unheard-of using conventional circuitry.

Fig.4: Part of the front cover of Radio and Hobbies for October 1950, showing a 'walkie talkie' transceiver for the 288MHz band using only two tubes. It used a super-regenerative detector in the receiver.

The 'Walkie Talkie'

Super-regenerative receivers had a brief reappearance just after the second world war, when radio amateurs used two- and three-valve handheld transceivers to operate on the two-metre (144MHz) and one-metre (288MHz) bands. In these circuits, high frequency 'acorn' valves such as the 954 and 955 were put to good use as they were available quite cheaply from disposals stores of the day.

For the receiver section, super-regeneration was invariably used as a very cost-effective means of obtaining sensitivity using only a short whip antenna. The number of valves was minimised, but more importantly, so too was battery current.

At that time, 1m and 2m equipment was still in the realms of experiment, and the bands allocated to the hams were fairly generous. Given these conditions, and the comparatively few hams who were using the band, the selectivity limitations of the super-regenerative receivers were of little consequence.

As the band became more popular and the various regulatory authorities reduced the bandwidth (and better and more powerful transmitting tubes became available) the days of the super-regenerative receiver were numbered. ❖

INFORMATION CENTRE

by PETER PHILLIPS

Touchlamps, lightning, cable TV, and more

This month we doggedly pursue my question about lightning and energy, and look at such diverse matters as the 'power good' signal from an IBM compatible power supply, the internal resistance of a Leclanche cell, and how touchlamps work. We also revisit the June What?? question to see how easy it really was.

I recently hooked up to Foxtel, and I thought you might be interested in my opinion of its technical quality. I take my video and sound quite seriously, and have a reasonably good home theatre setup: surround sound decoder, large screen TV, stereo VCR and so on.

I had previously considered Galaxy, after being told (incorrectly) that the off-air channels are included. When the installer arrived, he told me I would only receive the Galaxy channels, so I had to send him away. After all, one of the reasons I was considering cable/satellite TV was to get better reception of the free-to-air channels.

So when a Foxtel representative called I made sure I would get the off-air channels. I also showed him my home entertainment setup and asked if the direct audio output from the set top unit (STU) was in stereo. "Oh yes, most definitely." After discussing costs, I agreed to a six months trial.

I was home when the installers arrived, which turned out to be rather fortunate. Although I was paying a nominal $20 for the installation, the installers are paid somewhat more — although according to the supervisor, not enough to spend too much time on an installation. To speed up my installation, he suggested running the thick black cable down the outside front wall of my brick house. "You can paint it!" he retorted when I objected. Eventually it was located in the wall cavity, adding about 10 minutes to the installation time.

I didn't notice however that the cable in the roof was installed so that it ran diagonally over the manhole in the ceiling. Because it has absolutely no slack, I now have to be a contortionist to get into the ceiling. So if you don't take an interest in the installation, be prepared for anything.

I became quite friendly with the installer who completed my job, and was surprised to learn that his background was carpentry. However, he knew what he was doing, and talked about his work, with many anecdotes about some of the installations he had done.

By now I realised that the STU (model 100) did not have a direct stereo audio output, just a single mono output. You do get stereo via the RF output, but the picture quality is not as good as that from the direct video output. Foxtel, it seems, has no control over who gets what type of STU, but I did learn that STUs (model 120) with direct stereo output are currently being trialled. It seems I have no hope of getting one however.

So what's the picture quality like? To a non-discerning viewer, the picture is probably good enough. In my experience, many people don't really care what the picture quality is, providing it's watchable. But to me, it's quite poor. All channels have a grainy appearance, and if the material being transmitted is of poor quality, the resulting picture is weak and snowy. I've seen Foxtel in other homes, and my reception is as good (or bad) as any.

As it stands, my choice is stereo sound and poor picture via the RF output, or improved picture and mono sound from the direct video/audio outputs. When comparing the picture quality to that from a free-to-air broadcast, the difference is obvious to the least discriminating person.

A further aggravation that occurs only when using the RF output of the STU is a burst of white noise audio between each channel change, while the decoder locks in. On the other hand, the STU is easy to use and program, and you don't need instructions to program it for video taping.

As for program content, this is really a subjective thing. My family has found that it's the "extra" channels (Entertainment Plus and World Movies) that hold our interest, which increases the cost by $14 per month. The much vaunted Discovery channel comes in the basic package, but it seems to spend more time telling you what's coming up than giving interesting programs. And when you do get a program, it's usually rather old. The Beyond 2000 series is at least five years old, and if the topic is computers, it has little interest.

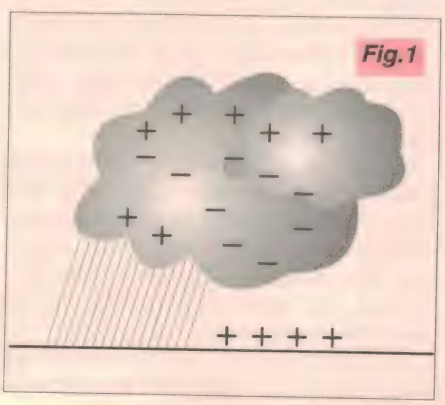
So I guess I'm not impressed with it, despite the technology, the fibre optic cables and all. At least I'm ready for a cable modem when Telstra gets its Big Pond fully functional. And that could be very useful, with download times of a few minutes for 20MB of data.

Now to our first topic, which concerns lightning.

Lightning and energy

In the July issue, in answer to a reader's letter, I asked the question — where does the energy in a thunderstorm come from? I proposed the possibility of water containing energy, perhaps originally stored by its exposure to the sun, and then released by whatever mechanism goes on in a thunderstorm. This letter comes from a reader who worked for the Bureau of Meteorology for some 30 years as the computer centre and installation planning manager.

I have enclosed a copy of an article by Bob Crowder, ex Assistant Director of the Bureau of Meteorology, and available from the AGPS for around $30. It



may not answer your question, but it might go some way in explaining how particular clouds are associated with thunderstorms and how the voltage levels are generated. The author's guess is that the sun is involved as the starting process in forming the clouds, but after that it's up to the clouds and the elements themselves. Thanks for your interesting and thought provoking articles. (Al Ebenreuter, Eganstown, Vic.)

Thank you Al for your supportive comments and for the article you sent. The article is called *Lightning Can Blow Your Socks Off* and makes the point "it is still not known with certainty exactly what produces the electrification ... in cumulonimbus clouds." Other points in the article refer to lightning striking in the same place, up to 15 times in 15 minutes in the case of New York's Empire State Building, and of the enormous potentials built up. The diagram in Fig.1 is from the article and shows the generalised charge distribution in a mature thunderstorm.

The main thrust of the article is really about the magnitude of the energy contained in a lightning strike, and its effects. Did you know for example that being struck by lightning can cause all your clothes to be blown off by the sudden heating and consequent expansion of air caused by the strike? Being struck by lightning is bad enough, but to be left naked as well! Hence the name of the article.

So although a most informative article, it still doesn't answer my question: where does the energy come from in a thunderstorm? Any thoughts?

Touchlamp

Ever wondered how those cute little touch-controlled table lamps work?

Recently I came across an unusual (to me, anyway) table lamp. It was conventional in appearance, with the lampholder at the top of a tubular metal column fixed to a circular metal base. The light is turned on by a touch anywhere on the base or column. The first touch brings it on at low brilliance, and subsequent touches increase the brilliance, with the fourth touch turning it off.

There is no gradual fade up; the effect is like a four position switch. The lamp is not grounded (it has a two-core flex) and you don't need to be earthed to operate it. You don't feel a "tingle" when you touch the metalwork. As far as I know it has a 240V lamp, as there's no room for a transformer. Any idea how it works? (Douglas Bolton, Mt Waverley, Vic.)

These lamps have actually been around for a while Douglas, and there are also wall mounted dimmers controlled by a touchpad that control room lighting in the same way. That is, there's no switch, just a smart looking metal plate.

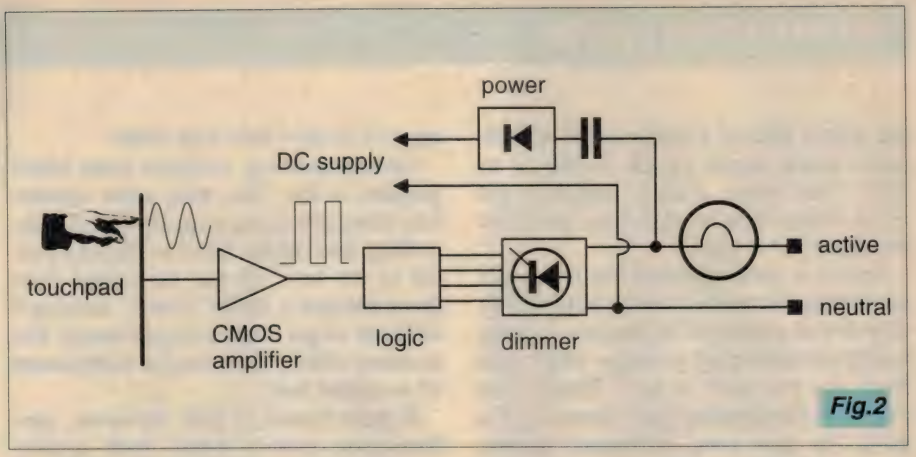


Fig.2

They have a special purpose IC with a CMOS input, which has a very high impedance. This input connects to the metalwork which therefore acts as a touchpad. When you touch the lamp, you are in effect feeding it a signal voltage. This happens because you (a conductor) are surrounded by an electric field from the mains wiring, which induces a voltage in you. You hear this voltage when you touch the "live" input to an audio amplifier.

The voltage is amplified and conditioned so that it can trigger a logic circuit that responds accordingly. The logic circuit controls the dimmer section. The basic block diagram is shown in Fig.2.

The power for the electronics is derived from the mains, typically through a series capacitor. The value of the capacitor is chosen to give a capacitive reactance at 50Hz that produces a voltage drop of around 230V AC. The remaining 10V or so is rectified and probably regulated, and supplies the electronics. The capacitor will be an external component, and being almost purely reactive, has no power loss and little heat dissipation. The fine details of the IC's operation are the manufacturer's secret, but are not complex.

So again the magic of an integrated circuit to achieve something that with discrete components would be quite difficult to build.

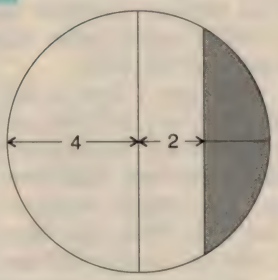
The June What??

This question has resulted in quite a lot of mail, with a number of readers sending me their solution to the problem. You might remember that the question was originally posed in a university entrance exam for a mathematics course, and that according to *New Scientist*, it foxed nearly all the applicants. But not so *EA* readers, I'm pleased to report. The question is shown in Fig.3, along with the diagram that was somehow not included with the solution given in July.

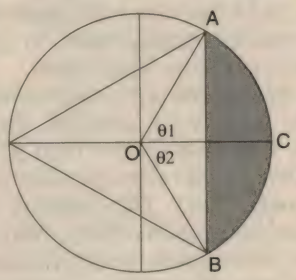
Most readers found the area by noting that the shaded portion was part of a sector of a circle. The complete sector of course is the area enclosed by OACB in (b). Finding the area of the triangle OAB is easy enough, as is finding the area of the sector. Subtracting one area from the other gives the answer.

Not everyone recognised that the area OACB is one third the area of the circle. This is so because angle AOB is 120°. As you know, the area of a sector is to

Fig.3



(a) find the area of the shaded portion of the circle



(b) the explanatory diagram that should have appeared with the answer

the whole area of a circle as the associated central angle (angle AOB) is to 360°. But some readers couldn't get away from integral calculus, and not everyone got it right.

So it's a good question, as it doesn't need complex maths, which is probably why it was presented in the test. A point worth remembering perhaps when you front up for such a test. Thank you everyone for sending your answers, it's good to see how different people approach such a question.

Omnidirectional speakers

The next letter seeks advice on the amplifier requirements for an omnidirectional speaker system based on a 1974 design.

After reading an article on omnidirectional loudspeakers from Philips Elcoma in the 1974 issue of EA, I wondered if the system described could be enhanced. I thought I might fit each speaker box with four 100W bass speakers and three 100W tweeters. But what sort of amplifier would I need?

I have a surround sound system with a 100W amplifier, but the speakers facing me give a dull sound. If I could make the sound reflect from the walls and ceiling, as well as being transmitted from the front of the speaker, I assume this will create a better sound area. (Leonard Ford, Morphetteville, SA)

Some years ago I saw a hifi setup comprising two very tall (two metres or more) speaker boxes, with about 12 low cost speakers per box. Half were bass-midrange, the others tweeters. The owner had also fitted two large bass speakers into the lounge you sat on to listen to the system. I remember it sounded impressive, and quite satisfying. The speakers in the lounge let you feel the sound, more than hear it.

His amplifier was relatively conventional, as he had wired the speakers in a series-parallel arrangement to give a nominal four ohms impedance.

I'm relating this story to illustrate that a large number of speakers does not always mean you need a high powered amplifier, unless you are after a very high sound level. The required power output of the amplifier for a given sound level is also related to the efficiency of the speakers. So in your case Leonard, you might find your 100W amplifier can deliver enough power, providing you choose efficient speakers. Just make sure you wire them to give an impedance of no less than four ohms.

Omnidirectional speakers were rather popular in the '70s, with some speaker box designs having a speaker facing the ceiling, and others fitted to sloping panels in the box. To me the sound from these designs is rather "loose", making it difficult to get a clear sound image. But to many others, the sound is reminiscent of a concert hall.

If your sound is dull, however, perhaps you merely need good quality tweeters. You already have surround sound, so perhaps adding more speakers might not be necessary if you are mainly after clarity.

Scart plug

The next letter came to us via our BBS, from a reader who mentions he's new to the BBS. Perhaps that explains why every second line in the text is missing! Still, I think I've got it sorted out.

I have a number of questions, starting with the connections for a Scart connector. My VCR has this type of connector and my TV set has four RCA sockets: audio in, audio out, video in and video out. What are the pin connections of the Scart connector so that I can connect the VCR to the TV set?

I also have a 5.25 inch floppy drive with a 36-pin male plug. Can I connect this drive to the 25-pin parallel port of my computer? If so, what are the connections?

Finally, I am after a kit or design for a microwave detector. Can you help? (Ben Despiney, BBS)

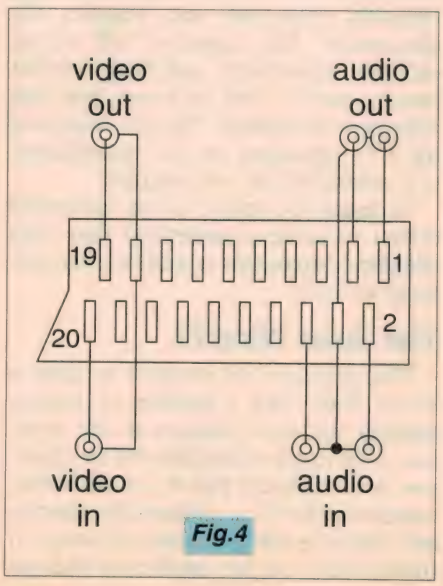


Fig.4

The Scart plug connections are shown in Fig.4 Ben. I've not included all the pinouts, as you are only interested in the audio and video connections. Your TV set has a mono audio input, while I assume your VCR has a stereo output. If so, you might want to hook up a stereo amplifier to get stereo sound from the VCR. Otherwise, you'll have to mix the stereo outputs from the VCR to get a mono sound. I don't recommend joining the audio outputs together. Or perhaps there's a stereo/mono switch on the VCR. Incidentally, the current Dick Smith catalog has the connections for a Scart plug.

Regarding your disk drive, I think it's probably got a 34-pin connector, not 36. (Unless you mean a 37 pin D-type connector, used in early systems to connect external drives to a floppy controller card.) I haven't given the pin connections, as there's no easy way to make the drive work via a parallel port. But then, I'm assuming it's an IBM compatible drive. If it's from some other system, let me know and I'll see if I have the pin connections.

We have never published a radar detector project, which I assume is what you are after. In any case, as these are now illegal, I doubt you'll be able to get the parts, as they are quite specialised. If you are after a device to detect leakage from a microwave oven, there was one published in ETI July 1979. However, I suspect that the Shottky Hot Carrier diode it used may be difficult to get as well.

IBM power supply problem

Are you confused about the 'power good' line from an IBM computer power supply? Our next correspondent appears to be...

How can I test an IBM power supply when it is not connected to the computer? There is a power good wire (orange, usually designated P8) which plugs into the main board. But how does one simulate this being connected to the board? These power supplies would make a good supply for an amateur or CB transmitter, but they won't power up unless connected to the computer motherboard. (Peter Hughes, BBS)

It seems you have only tested a relatively old type of supply Peter, perhaps from an AT or even an early PC. But the problem is not the power good line, it's more likely the lack of a load. The power good signal is an *output* from the power supply and if the 5V line is cor-

rect, it goes high and enables the clock generator, and hence the complete system. If this signal is low, nothing runs on the motherboard, even if the supply is generating correct voltages. However, these days most IBM compatibles have the 'power good' circuitry on the motherboard.

Early supplies, like those from an AT often need a load to operate. Later supplies generally have an internal load, so they can be bench tested without being connected to anything.

Because there are four output voltages, you might need four separate loads, one per output voltage. A lamp is ideal, as it not only serves as a load, it indicates the presence (or absence) of an output voltage. As for powering a transmitter, make sure the 12V output has a current of 4A or more. Early supplies were rated at 2A for the 12V supply, which is probably not enough for a transmitter.

Leclanche cell

Here's an interesting question about the Leclanche cell:

I am a second year electrical engineering student and I need some information on the internal resistance of a zinc-carbon cell. Specifically I recall an EA article on the history of batteries, which I believe said that a Leclanche cell has the quirk in which the internal resistance drops with increased current. This has apparently been experimentally confirmed by a number of people. I'd be very grateful if you could tell me what issue the article was in, as I can't find it in my index. Could I suggest you also put features and technical articles into database form? I'm sure many people would find it useful. (Andrew Punch, BBS)

I've searched our database Andrew, and I can't find any reference to such an article. That's not to say the article doesn't exist, because, as you say, not everything we include in the magazine is in our database. I've not heard of the phenomenon you describe, although I can quite believe it's true. Interesting too, as the main problem with a Leclanche cell is the increase in internal resistance due to polarisation as the chemical action takes place. Perhaps a reader might remember the article, or can give you a reference.

Project ideas

We often get suggestions for possible projects, and we try to act on these where we can. The first of the two suggested by our next correspondent might be difficult for us to test, but both projects seem interesting.

I'd like to pass on a couple of ideas for possible projects. The first is a noise generator that can be fitted to a car, to deter kangaroos. These are available commercially, but a project perhaps along the lines of the woofer stopper published by your competitor might work.

The second idea is a 'loss of power' indicator. It could be a battery powered circuit in a small box that connects to the mains. If the mains is lost during the night, it could alert you either with an audible alarm or a flashing LED so that you don't rely on the time shown by your bedside clock. (Dion Mikkelsen, via email)

Interesting ideas Dion. I'm told the woofer stopper project you refer to does in fact deter kangaroos, along with dogs and most animals. I don't know whether it would make a kangaroo jump off the road as you approach it in a vehicle, but it could be worth trying. The loss of power indicator should be simple enough. Perhaps a reader could develop it and send in a design for our Circuit and Design Ideas column. We will also put it on our list.

$10 water control system

Our new $10 Wonders section is proving popular, but perhaps the next letter is asking a bit much for a simple circuit.

Would it be possible to modify the Water Alarm described in your $10 Wonders section (May 1997) to include a relay in place of the speaker? It would make the design more useful, and allow it to be used perhaps in a hydroponic application. It might increase the cost, but I think it would be a worthwhile addition. (Mark Roebuck, Lithgow, NSW)

The modification you suggest makes sense Mark, but it's easier said than done. As it stands, the circuit is really to detect the absence or presence of water, not to indicate moisture content. It operates by enabling an oscillator, causing a speaker to sound when there's water between the probes.

Using it to sense moisture content is possible, perhaps by adjusting the probes so the oscillator is enabled at a certain moisture content. But just how reliable it would be is difficult to say. In any case, the circuit then needs an additional stage to convert the AC signal from the oscillator to a DC switching signal. This could then be used to operate a relay as you suggest, probably via the MOSFET.

Still, we'll ask the author of the series to investigate. In the meantime, if you have access to back copies of ETI, there was a Soil Moisture Indicator in the November 1980 edition. It might suit your needs, but as I can't find a copy, I can't be sure.

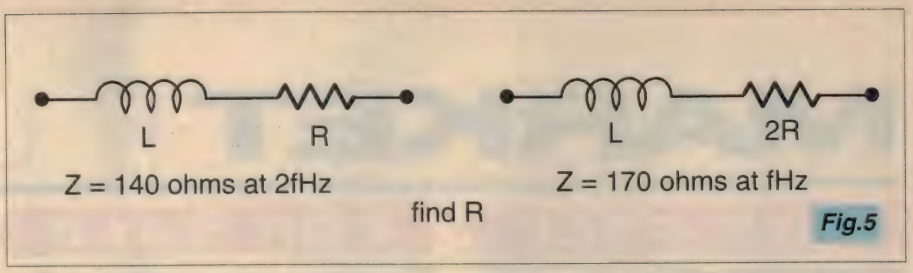


Fig.5

What??

The question this month comes from Douglas Bolton (Mt Waverley, Vic), who has kindly responded to my request for suitable puzzlers with an electronic "flavour", And this one is certainly that. It's easy enough, and doesn't need complex maths. Douglas asks:

An inductor L and resistor R in series have an impedance of 140Ω at a frequency of 2fHz. The same inductor and a resistor of 2R (twice the resistance of the previous resistor R) have a series impedance of 170Ω at fHz (half the frequency of before). What is the value of resistor R? The circuit is shown in Fig.5.

Answer to August

The work needed to turn the screw is provided partly by the person turning the handle, and partly by the electrostatic attraction between the plates. When the plates are moving, the attraction force does work, and therefore expends energy. That's where the missing 250,000J went!❖

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13	38	63	88	113	138	163	188	213	238	263	288
14	39	64	89	114	139	164	189	214	239	264	289
15	40	65	90	115	140	165	190	215	240	265	290
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23	48	73	98	123	148	173	198	223	248	273	298
24	49	74	99	124	149	174	199	224	249	274	299
25	50	75	100	125	150	175	200	225	250	275	300

Moffat's Madhouse...

by TOM MOFFAT

Is there ANYTHING on Pay TV tonight?

This month marks another landmark in the sordid history of Moffat's Madhouse. It's our seventh anniversary, celebrating the fact that 84 columns of miscellaneous drivel have now been foisted upon you long-suffering readers.

In past anniversary columns I've sometimes been compelled to look back over the years. This month is no exception, but it's only a coincidence; nothing to do with anniversaries. Instead I got inspired by two publications sitting on the floor next to me. One is Jim Rowe's editorial in the March issue of *EA*. The other is a lift-out from our local *Peninsula Daily News* called TV Week — the weekly television guide for our area.

Almost exactly four years ago we ran a Madhouse column entitled 'Expanding the Cretinizer', referring to plans to introduce Pay-TV into Australia. We discussed the various technical ways of delivering signals, such as cable and satellite, but then I asked a rather irreverent question: "...in the midst of all this, does anyone really care? It's interesting to note that nobody seems to have asked potential viewers if they want Pay-TV in the first place".

Now I learn, from Jim Rowe's editorial, that Pay TV in Australia is facing 'lukewarm subscriber interest'. This is interesting; I haven't seen any Australian newspapers here, for the simple reason you can't get them, so I had heard nothing about the success or failure of Pay TV in Australia. In fact I'd forgotten all about it. So, it seems, have many other people.

I get a lot of e-mail correspondence from Oz these days, especially since that Virtual Tom visit to the TV station reunion mentioned in Madhouse a couple of months back. These are old friends from the TV industry I'm communicating with, and most of them are still gainfully employed, in free-to-air broadcasting in several cities. I have not heard one comment, from anybody, about Pay TV or Cable TV or anything. One would think, if these new TV services were any real competition to existing operators, they would be moaning loudly. But there's been nary a squeak...

So why isn't Pay TV a bigger threat to existing operators? Why aren't more viewers clamouring for Pay TV? Jim Rowe hit the nail right on the head: not much worth watching. Plenty of sport, Jim says, which isn't any surprise since it is Australia we're talking about. And re-runs of movies and old TV series. Well, tortured viewers of Australia, you ain't alone, and the grass certainly isn't any greener here in the USA.

What we seem to have here on cable TV is programming in four broad categories. One: sitcoms. Two: soapies. Three: mediocre movies. Four: re-runs of One, Two, and Three. There is also a splinter group of 'educational' material *a la* Discovery Channel, Learning Channel, etc. — and most of that is very, very good. But it isn't wildly popular, so it's not there in great quantity. Same goes for the cable news services such as CNN. Sport is most often delivered by the Direct Satellite Broadcasting service, described in *EA* in August 1996.

What viewers want

It is probably an indisputable fact that what comes over the cable is what cable viewers want to see. That doesn't say too much for the discrimination of cable viewers. But it explains a big mistake I made in the column four years ago when I said, "It seems that just about every home in the USA is hooked to cable TV. It's like the fridge and washing machine; every home must have one."

The problem *there* was an incorrect statistical sample. When I made that observation, I was visiting elderly relatives in the USA. With them, I in turn, visited many of their elderly friends. And just about every one of them had cable TV...

But now, living in the USA, I visit homes of younger people. And, as I sit here writing this, I can't think of any home I visit which has cable, except for one — the home of an aunt and uncle in their eighties. So, on the surface at least, it looks like cable TV is common in the homes of old people, but not young people. In fact most of my friends have little interest in TV of any kind.

It's interesting to see how the oldies use their TV. Many of them are housebound, so TV is their major form of entertainment. My aunt and uncle each have recliner chairs, pointed toward a big 26-inch set. They have two identical remote controllers for the one telly, and they channel-surf. There are 40 channels on the cable, and they go blip-blip-blip until some action on the screen attracts their attention. Then they stop, but only briefly. Rarely have I seen them stick with one program for its entirety. When there are arguments about which channel to dwell on, there is often a session of 'remote wars' with both controllers blasting away at once.

Jim Rowe mentions high 'churning rates' in Australia — households signing up for Pay TV for a three-month trial, and then dropping out because they didn't find the service worth having. I did exactly the same thing here in the USA. When my son and I moved into our rented house, cable TV was already connected; the previous tenant had obviously neglected to cancel the service. So we watched 'free' cable for a few weeks. I didn't use it much, but my son seemed to spend an enormous amount of time locked into the Cartoon Channel, available 24 hours a day.

After seeing the telly start up at 6:00am some days and keep going until bedtime, running mostly cartoons, I decided we had had enough of cable. So I went out behind the house and disconnected the thing myself, rather than call in the cable company and get stuck with a previous subscriber's unpaid bill. And the cable has remained disconnected to this very day.

We don't miss our Pay TV. Our little town of Port Townsend is within the

free-to-air viewing area (if you stretch the point a bit) of three major cities — Seattle in Washington, and Vancouver and Victoria in Canada. We can get most of the Seattle stations, and some Vancouver ones, on rabbit ears. Many homes here have squatty little masts on their roofs, that look like miniature four-legged windmill towers. These are topped with big VHF/UHF fringe area arrays, mounted on rotators. Anyone with a half-decent location can then get every station, VHF and UHF, in all three cities.

Cleaner signals

Maybe that is why cable isn't so popular here. It's primary use seems to be to deliver clean signals from the free-to-air stations. The cable company's 'head-end' complex, situated in a residential area, has a couple of satellite dishes and a microwave link to deliver proper 'cable' channels, but much more impressive are the two towers festooned with individual yagi antennas for each of the free-to-air channels they relay down the cable. The point is, they're getting the stuff off-air, so why can't local homeowners? Most can — which explains why Pay-For cable isn't a big deal here.

So what's on offer from the cable channels, say on a mid-week evening? At 7:00 on Wednesday we can watch re-runs of The Waltons, followed by Highway to Heaven. There's a talk show with some guy interviewing an actor; Delivery Room — a preview of new country music videos; Doug, Stolen Bike (whatever that is); a charming film called *Yogi and the Invasion of the Space Bears*; and Fresh Prince of Bel-Air.

If I had cable, I would probably watch something called 20th Century with Mike Wallace, about criminal activity on the Internet. And that's all for the night. I just don't think it's worth paying thirty bucks a month for that.

Meanwhile, on free-to-air, Wednesday evening is a Star Trek frenzy with hour-long episodes of Deep Space Nine, Voyager, and Next Generation plastered all over the schedule. By channel surfing it is possible to watch three continuous hours of Star Trek from 8:00 to 11:00. And you'll still miss one episode, because two are running concurrently.

There's even a weekly column in the *Seattle Times* devoted exclusively to Star Trek happenings.

Other than Star Trek, the menu reverts back to sitcoms and soapies. So after the news, it's a black-screen night in the Moffat household.

Black screen. That has to be the bane of TV executives everywhere. Sets-in-use falling away; as tellies are powered down out of sheer boredom. People are then forced to have conversations with each other, or if that's too hard, they watch videos. Back to my elderly aunt and uncle — it seems the only time they will sit still and watch a whole program is if it's on a video instead of TV. Maybe it's because they feel they are in the driver's seat, instead of being forced to accept whatever drivel might be shoved down the cable.

There is one more phenomenon in America that is turning viewers toward cable, and away from free-to-air and the black screen. More and more 'community TV' stations are springing up all over the country. These interesting stations allow just about anyone who wants to, to make and air programs. Well, not 'air' exactly — their programs are squirted down the local cable system.

Community TV stations are mandated by the Federal Government. For a Pay TV operator to be granted a licence, they must provide an outlet for members of the public to have their say. This usually means setting aside one channel on the cable for public access. Sometimes it's possible to put pressure on cable operators so they have to provide the studio equipment as well as the air time.

The beauty of Community cable TV is that its content is entirely local. Some community stations have video cameras to loan out to anyone who cares to ask for one. Later the amateur program-makers come back with a tape, which is put to air. Part of the Community stations' charter is that there can be no censorship. If you give them the tape, they have to play it. The only exception is if the home-made program is advocating something illegal, such as drug-taking.

Just tonight on Seattle commercial TV news, I saw a story about a weekly program running on community channel 27 in Seattle. It's made by a woman in her living room, and she appears on camera totally nude. She is 'expressing herself'. It was interesting watching the commercial station show clips from the program while trying to blot out all the naughty bits...

The more up-market community TV stations run their own news services, very local in nature, and sometimes quite professionally produced. Often the stations are associated with schools, as are many community FM stations in both the USA and Australia. Here in Port Townsend, plans for such a community TV (and FM) station are progressing nicely. The station is to be owned and operated by the city council, and funded in part by the cable TV operator as part of the price for holding the exclusive cable licence in the area.

Studios are almost certain to be located at Port Townsend High School, the place I was teaching TV and radio production last year. And it's intended that the station be mostly student-run, under paid adult supervision. So guess who's wangling for one of those jobs? I've already started producing some Education Department programs being aired on cable TV, so the foot is well and truly in the door...

I don't know how the law stands in Australia, but hopefully there is some provision for community input into the Pay TV systems there. We know that viewers are 'churning' out after three months, and maybe they are sick of sport. But what if local parish-pump issues could be presented in a weekly 'Town Meeting' program, aired live throughout their area on one of the cable channels? Or what if the basketball player flashing across the screen was one of THEIR kids? That might be just the thing needed to push Pay TV into otherwise unenthusiastic homes. Who will be first to try it? ❖

REMOTE CONTROL

(Continued from page62)

sends its signal to a receiver whose IR LEDs are pointed at a second transmitter. This transmitter relays onto the second receiver mounted in the room with the equipment. You'll probably need to fiddle with the tuning to prevent "feedback", by making the second UHF link operate at a slightly different frequency from the first.

Another application for this system is with a cable TV setup, where for instance you've connected a second TV set to the set top unit (STU), with the second set in a different room from the STU. The idea is to place the transmitter so that it can pick up the IR transmission from the remote control for the STU, rather than to attach it to this remote. For example, place the transmitter on the TV set you are watching. You'll need to reposition the photodiode so its active surface points towards you, rather than away from you as for its usual application.

The receiver module is placed so it controls the STU, receiving its information from the transmitter.❖

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Here we feature some items from past issues.

September 1947

Radar Device Clocks Motorists: It may soon get tough to die from illegal speeding. A 'little black box' may do the trick. The device, called an electromatic speed meter, utilises war developed radar to clock within a 2mph accuracy the rate of any moving vehicle travelling up to 100mph. From the small, compact box, which is easily concealed, and is attached to a recording device by a cable, microwaves are beamed in a particular operation zone. All vehicles entering it reflect the waves, and the shift in the wavelength from the original is automatically printed on the linear scale of the recorder. The variation is translated into miles per hour.

Both the transmitter and the recorder are powered by a storage battery, which may be the one from the car of the police, who monitor the instrument and note the licence numbers of speedsters. The Connecticut State Police recently conducted a traffic test of the device.

September 1972

Colour tube with no convergence adjustments: American colour TV tube makers are moving toward the Sony Trinitron concept in their new lines of smaller sized colour tubes. GE, Sylvania and RCA are all bringing out new lines which use vertical-slit shadow masks and phosphors arranged in vertical lines instead of the tri-dot pattern of the old delta system.

This marks the first major design shift for the American makers since the tri-dot technique was introduced in 1954. The major advantage of the vertical slit system is more picture brightness. Also, errors in vertical positioning do not cause colour differences. But the real advancement in tube technology is in the yoke. The GE and Sylvania designs have reduced the dynamic convergence adjustments to four, from the 12 required by the delta system — and RCA has completely eliminated convergence adjustments. RCA's trick is a permanently attached yoke, cemented to the CRT, that eliminates all adjustment circuitry.

Philips seeks more agreement on VCR format: In a move to get worldwide standardisation of video tape cassette systems, Philips is freely offering details of its 'VCR' cassette system to any manufacturer who will sign a standardisation agreement. Philips successfully followed the same course in the early 1960s, to get industry-wide agreement on the format of the audio 'Compact Cassette'.

The VCR system, demonstrated in Melbourne last month, is similar to the Compact Cassette system in appearance and ease of operation, although the cassettes are of necessity much larger to accommodate the 1/2-inch video tape. In Europe 10 companies have signed up. ❖

EA CROSSWORD

ACROSS

1 Communications link. (8)
5 Neville ...., distinguished audio engineer. (6)
10 Invented. (7)
11 Put equipment, etc, into place. (7)
12 Outdated energy units. (4)
13 TV violence censoring component. (1-4)
14 Computer suggestion box? (4)
17 Having no musical key. (6)
18 Storage factor: .... life. (5)
21 Emission from the Sun. (5)
23 Fixed part of an electrical generator. (6)
25 Brand of computer; maple genus. (4)
27 Supports microphones. (5)
28 Image on a CRO. (4)
31 Study of carbon compounds: .... chemistry. (7)
32 (Of tape deck) In operation. (7)
33 Characteristic of electrons: .... levels. (6)
34 Name of space shuttle. (8)

SOLUTION TO AUGUST 1997:

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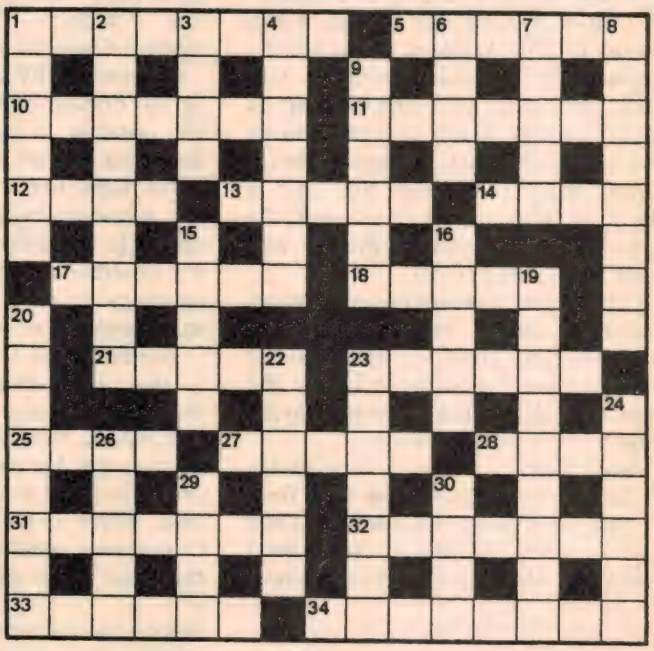

DOWN

1 Long array of similar components. (6)
2 Name of GPS receiving device. (9)
3 Diminution of power. (4)
4 Pertaining to astronomical nodes. (7)
6 Screen mush. (4)
7 Remove recorded data. (5)
8 Satellite obscurations. (8)
9 Restricts. (6)
15 Electrode. (5)
16 State-of-the-art instrument maker? (5)
19 Reception area of satellite transmission. (9)
20 Mobile phone network. (8)
22 Study of light behaviour. (6)
23 Site of intense solar activity. (7)
24 Powered sections of a rocket. (6)
26 Famous lunar module. (5)
29 Obstruction to passage of line. (4)
30 Space organisation. (4) ❖

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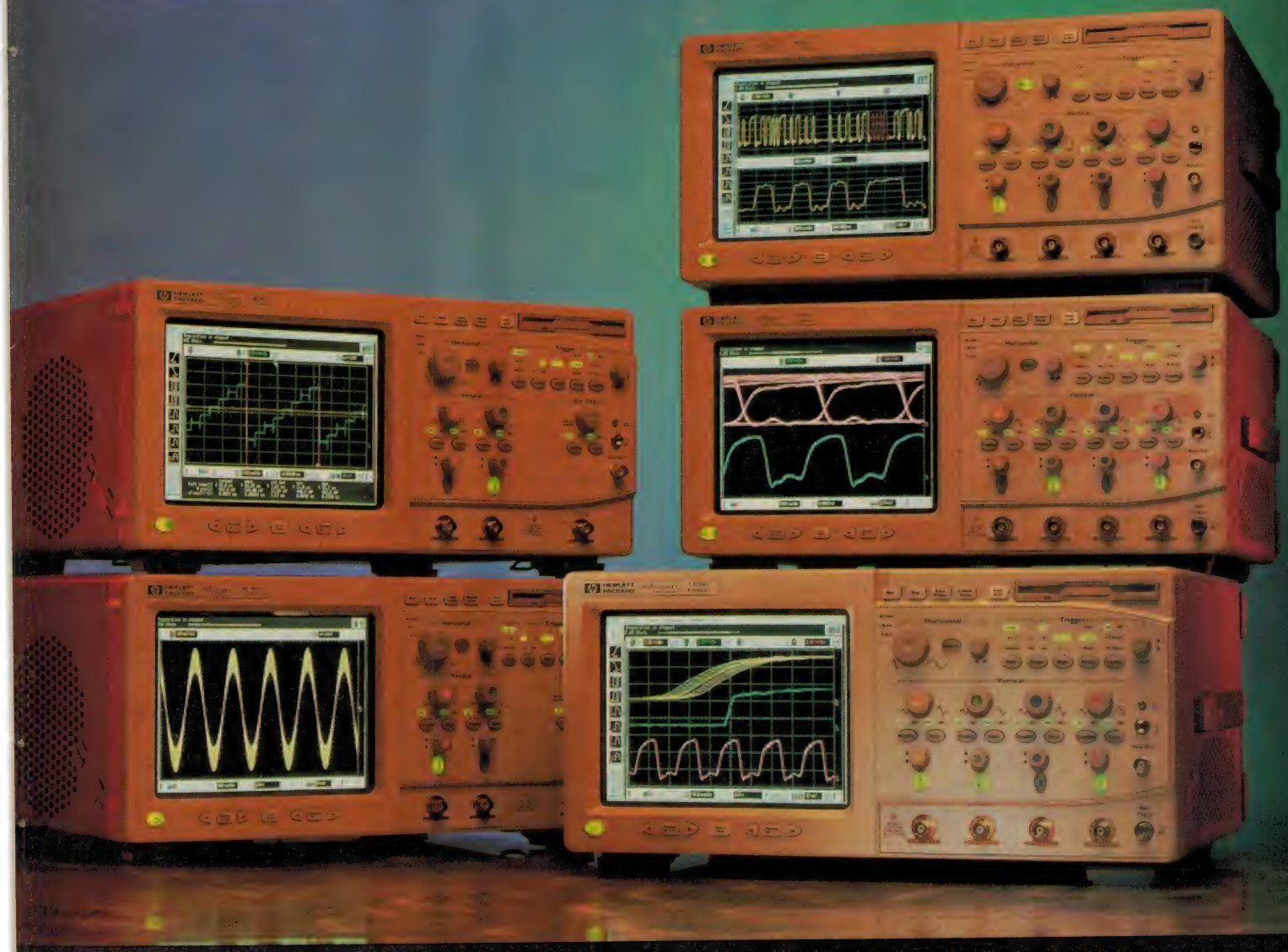


HP'S IMPRESSIVE NEW HIGH-PERFORMANCE 'INFINIUM' OSCILLOSCOPES: INTUITIVE FRONT PANEL WITH 'ANALOG LOOK & FEEL', PLUS A FULLY INTEGRATED WINDOWS 95 BASED GRAPHICAL USER INTERFACE WITH 'DRAG & DROP' MEASUREMENTS, EXTENSIVE ONLINE HELP FACILITIES...

NEWS HIGHLIGHTS

NEW HP 'INFINIUM' SCOPES HAVE INTUITIVE PANEL, GUI

Instrumentation leader Hewlett-Packard has announced a new family of high performance oscilloscopes, the 'Infinium' series, in which great emphasis has been placed on intuitive usability and ease of operation. The new instruments are the result of a US$1 million research study commissioned by HP, which showed that users of modern high-end scopes were generally satisfied with instrument performance, but still very frustrated by their complexity of operation and unfriendly user interfaces.

HP's research showed that high-end scope users were unhappy about the complex front panels, multiplexed controls and multi-level menu systems based on software-defined function keys. Overall they wanted front panels more like traditional analog scopes, so that basic operation was simpler and it was also easier to configure the instrument for complex measurements that were infrequently performed. They also wanted a faster way to get competent help in using the instruments.

Based on this market research, HP's Electronic Measurements Division scrapped their existing designs for a new series of high-end scopes, and came up with the new Infinium series incorporating a simpler and more intuitive front panel, a fully integrated graphical user interface (GUI) based on the widely used Windows 95, and a comprehensive built-in online help system.

"Listening to engineers has made a big difference in our product design", said Dan Oldfield, HP's Infinium business team manager. "We're confident that the Infinium oscilloscope family will help engineers spend less time fighting with their scopes, and more time focussing on the task at hand."

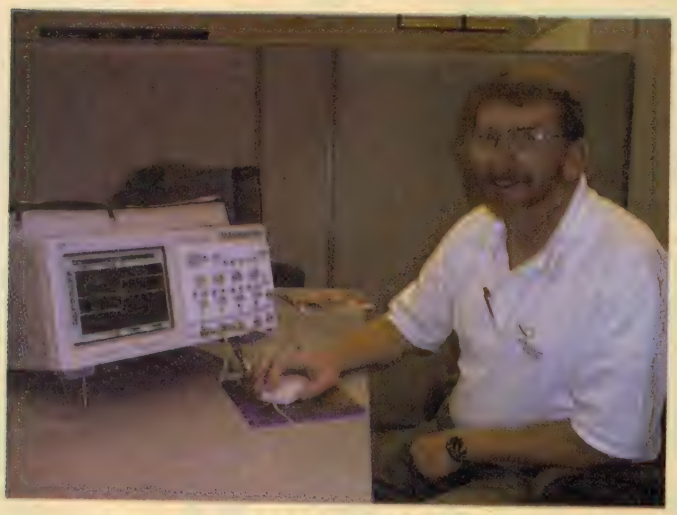
There are five new Infinium models, of which four offer a bandwidth of 500MHz and 32K of memory depth per channel. The two-channel 54810A and four-channel 54815A provide a top sampling rate of 1GS/s per channel, while the two-channel 54820A and four-channel 54825A have a top sampling rate of 2GS/s per channel. The top of the range 54845A has a bandwidth of 1.5GHz, and offers either four-channel operation with a top sampling rate of 4GS/s per channel, or two-channel operation with up to 8GS/s sampling and 64K memory depth per channel.

All five instruments provide an 'analog-like' front panel which sets new standards for simplicity and ease of use, with no control multiplexing or soft keys. They also use a large colour display based on a high quality LCD panel, and employ colour coding of controls to link them with the channel they serve. Backlit control legends also make clear the setup configuration at all times.

Even more impressively, though, the new scopes incorporate a fully integrated GUI based on the familiar Windows 95, and navigated using a standard PC-type mouse. This allows fast and easy selection of both simple and complex measurement configurations and functions, using features such as graphical-icon toolbars, drop-down menues and pop-up dialog boxes showing all available options. These are all used in a manner identical to the applications running on the PC on most engineers' desks. Setups can also be saved and recalled easily on floppy disk, to save time in situations where the instruments must be shared by a number of users.

Included in the GUI functions are features like the ability to 'zoom in' on waveform details by pulling a 'bounding box' around the area of interest, and then simply clicking within it; and the ability to make various measurements by 'grabbing' a toolbar icon and dropping it on the desired waveform at the appropriate spot. Also built in is a comprehensive online help system, which offers sound step-by-step instructions for quickly setting up the instrument to make each kind of measurement — including complex and little-used functions. There's even a self demo, to acquaint new users with the scope's functions.

Prices for the new HP Infinium scopes range from A$14,461 to A$43,543. Further information is available on the Web at **http//www.hp.com/info/infinium1**, or by calling HP Australia's Customer Service Centre at 131 347.



HP's Infinium business team manager Dan Oldfield demonstrating one of the new scopes.

ABC TO USE OPTUS AURORA SYSTEM

Australia's national broadcaster, the ABC, has chosen Optus' new Aurora digital satellite system to deliver its remote area television broadcasting services (RABS), in a deal estimated to be worth around $30 million. The five-year contract will see the ABC's Homestead and Community Broadcastings Services (HACBS) delivered to remote Australia using the latest MPEG-2 digital television compression technology.

The ABC will be delivering ABCTV and some radio services such as Radio National and ABC FM via Aurora, using both Direct to Home (DTH) and terrestrial re-transmission methods. Transition to the new digital service is expected to start later this year, and is described by the ABC as a cost-effective move to the new transmission technology.

Optus' Aurora satellite platform is the result of an investment by Optus to convert satellite transponder capacity from analog to digital on the Optus B3 satellite. B3 is also currently used for DTH Pay TV services.

PHILIPS & LUCENT LINK FOR CONSUMER COMMS

Philips Electronics NV of the Netherlands and Lucent Technologies of the USA have announced their intention to join their consumer communications products businesses into a jointly-owned venture with combined turnover in excess of US$2.5 billion, subject to mandatory consultations and the necessary official approvals. With 60% of the shares held by Philips Electronics and 40% by Lucent Technologies, the joint venture will be called Philips Consumer Communications and is expected to be the immediate world leader in corded and cordless phones, and also answering machines. It will also have significantly strengthened capabilities in the wireless arena.

The new company will develop, manufacture and market a wide range of products including digital and analog cellular phones, corded and cordless phones, answering machines, screen phones, pagers and other mobile electronic devices.

The joint venture will be headquartered in New Jersey and established under US law, with regional offices around the world. It will thus have convenient access to the advanced technological capabilities of Bell Labs, as well as to the key US communications market.

UNSW PHYSICIST WINS HUMBOLDT PRIZE

The Humboldt Foundation in Germany has awarded a 1997 Humboldt Prize to Professor James Scott of UNSW's School of Physics, to boost his research in solid state physics. The prize, including an award of $100,000, will permit Professor Scott to spend six months this year and six months in 1998 at two German institutes. On June 1 he and his family left for the Max Planck Institute for Microstructural Physics in Halle, and next year he will spend his time at the Technical University of Aachen.

While in Germany, Professor Scott will do experimental studies and device modelling of thin-film memories.

"These memories are non-volatile; that is, they do not erase or 'forget' if the power is interrupted. But they can be erased or rewritten more than a thousand times faster than any other non-volatile devices, such as EEPROMs (electrically erasable programmable read-only memories)", he said.

With two engineers, Professor Scott founded a spin-off corporation in the USA in 1986, six years before moving to Australia, to make computer memories and related devices from their inventions at the University of Colorado, where he had been Professor of Physics for more than 20 years. Today the company, Symetrix Corporation, licenses its technology to 14 multinational corporations, including Siemens, NEC, Motorola, and Matsushita.

Professor Scott told a recent UNSW Physics colloquium that Matsushita was now using Symetrix' technology to make five million chips per month, for use in digital telephones.

In addition to the $100,000 award, Humboldt winners get nearly free German post-doctoral assistants for five or more years; there are funded return visits to Germany and there is an annual banquet hosted by the Chancellor of Germany. At this year's banquet, Professor Scott will receive his Humboldt Prize from Helmut Kohl.

SIEMENS SAW CHIP PLANT FOR SINGAPORE

Siemens Matsushita Components is investing more than A$53 million into a fully integrated surface-acoustic-wave (SAW) device R&D and manufacturing plant in Singapore. The new project will expand the company's manufacturing capacity for SAW devices — until now exclusively located in Munich, Germany — and enhance its existing SAW design centre in Singapore. The 6000m^2 complex will house design, production and administration facilities.

Construction on the building has already begun and production is due to start in the middle of 1998. The newly established Siemens Matsushita Components Pte Ltd in Singapore will eventually employ over 200 people, mainly engineers, technicians and highly qualified specialists.

SAW devices are key components in modern information technology and telecommunications. Today's TVs, video recorders and satellite receivers would hardly be imaginable without them, and cordless and mobile phones owe them their compact design, high performance and long standby times.

The fine structures of 0.3um called for in SAW filters are deposited on the wafer with accuracy down to less than 0.1um using high-resolution photolithographic processes under Class-10 clean-room conditions. As a result design and production of these devices require the same high standards of personnel and equipment as do highly integrated semiconductor chips. The automated manufacturing equipment and clean-room installations will be among the most advanced in the world.

Siemens Matsushita Components claims to be the market leader in SAW

devices, recording sales of more than A$238 million in 1996. The world market for SAW devices is currently worth some A$615 million and is expected to grow to about A$1.3 billion over the next five years. The Asia-Pacific region in particular shows high growth rates, especially where filters for mobile radio are concerned.

KODAK & MOTOROLA TO TO DEVELOP CMOS IMAGER

Eastman Kodak Company and Motorola Semiconductor Products Sector have announced that they are working together to develop Advanced CMOS Imager (ACI) technology. By combining Motorola's manufacturing and semiconductor integration capabilities with Kodak's technology expertise in digital imaging products, the two companies plan to develop CMOS sensors for use in the growing digital imaging marketplace. CMOS (Complementary Metal Oxide Semiconductor) is a high performance, low power manufacturing process with integration capabilities that make it ideal for low cost, high volume digital circuits.

"CMOS image sensors are broadly applicable to our future high-volume digital products, complementing our line of high performance CCD (charge-coupled device) imaging sensors," said Robert Unterberger, president of Kodak's Digital and Applied Imaging Division.

Hector de J. Ruiz, president of Motorola Semiconductor Products Sector, views the partnership as a direct path to sustaining growth in new markets. "The ability to integrate vision capability with mainstream CMOS manufacturing will add a new dimension and excitement to the way people communicate — beyond voice and data to transporting information through images."

ACI sensors will be manufactured on the ImageMOS technology platform, featuring outstanding image quality with low-power consumption. ImageMOS is based on a standard CMOS manufacturing process with enhancements and controls that improve imaging performance. This technology will allow Motorola and Kodak to create a totally integrated solution by combining analog and microprocessor technologies onto the sensor chip. Employing advanced design systems, Motorola and Kodak will be able to create market-specific image solutions addressing a broad range of applications.

"Advanced CMOS imagers are particularly attractive for high volume, low cost digital still cameras. The lower power consumption and ability to integrate more functions onto the image sensor will enable the design of smaller, lighter cameras with longer battery life", said Jeffrey Peters, GM and VP of Kodak's Digital and Applied Imaging Microelectronics Group.

DIGITAL RECORDER USES MINI FLASH CARD

Olympus' new Digital Voice Recorder, the D1000, is claimed to be the first employing the new miniature removeable flash memory cards developed by Intel. Coupled with the fully solid state nature of the device this is expected to create a whole new category of compact and convenient voice recorder.

User friendly, the D1000 comes loaded with many features including removable flash memory card, over-write recording, insert recording and LCD information display. It measures a mere 120 x 46 x 23mm (H x W x D) and weighs only 170g with batteries.

The recorder offers a choice of two recording modes, designated 'Standard' and 'Long'. In Standard mode recording time is 16 minutes with a 2MB card and 33 min with a 4MB card. In Long mode these times extend to 34 min and 72 min respectively. The D1000 comes standard with one 2MB card, but additional 2MB and 4MB cards can be purchased for increased storage.

An interesting feature of the recorder is 'silent compression voice activation' (SCVA) — an innovative silence compression algorithm which dynamically selects one of two bit-rates, depending upon the incoming speech activity. This allows saving additional memory space by coding silence at a lower bit rate.

Digital recordings can be transferred from the D1000 to a PC via an optional PCMCIA card adapter, assuming the PC has a PCMCIA slot. This makes e-mailing of voice files a reality.

Further information on the Olympus D1000 Digital Recorder can be found on the web at **http://www.olympusamerica.com/recorder/dl000/dl000.html**.

WORLD'S MOST ADVANCED AUTO TOLL COLLECTION

TransLink Systems has awarded a contract to CSC Australia to build the world's most advanced automatic toll collection and funds transfer system for Melbourne's new $2 billion City Link tollways project.

Up to 20 software engineers complemented by hardware, workflow and banking specialists will work on the multi-million contract over the next two years. They will design, develop and implement the Central Toll Collection System (CTCS), which will instantaneously deduct toll fees from motorists' tollway accounts as they travel along the expressways. Motorists will not be required to slow down or stop.

CTCS will also transfer collected tolls to the bank accounts of TransLink Operations, the tollway operators.

The first section of the system is scheduled to go live in December 1998 in time for the opening of the Western Link in early 1999.

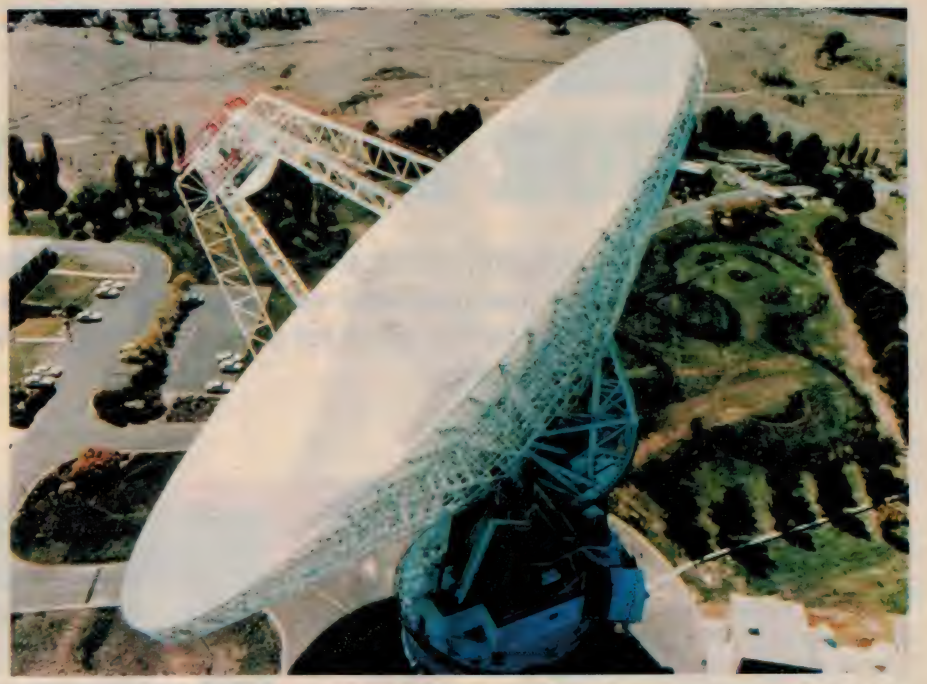
TransLink specialises in electronic tolling and traffic management systems integration for the Transfield Obayashi Joint Venture, designer and constructors of Melbourne's City Link

project for Transurban.

The contract with CSC Australia, together with the Saab Combitech contract awarded earlier this year for the supply of roadside toll equipment and 600,000 vehicle transponders, are major steps in delivering a fully integrated electronic tolling system for the Melbourne City Link.

The project will create 22km of new and upgraded expressways and 5km of tunnels and bridges under and over the Yarra River. It will enable motorists to travel from one side of Melbourne to the other with electronic systems collecting tolls at motorway speeds. Transceiver equipment attached to roadside overhead gantries will electronically collect the tolls by communicating via microwave with transponders about the size of a cigarette packet attached to vehicles' windscreens.

TransLink Systems anticipates that 600,000 vehicles a month will use City Link, with up to 2500 cars an hour using each lane.



The Tidbinbilla deep space tracking station near Canberra has installed a Cabletron MMAC-Plus switching and spectrum management platform to make communication with deep space probes faster, more reliable and less expensive.

MICROELECTRONICS 97

The Microelectronics '97 Conference will be held in Melbourne at the Ibis Hotel, from September 28th - October 1st 1997. Registration is on Sunday September 28th, followed by the conference days on Monday, Tuesday and Wednesday morning plus an exclusive technical visit to wind up activities on Wednesday 1st October.

The IREE Society — affiliated with the Institution of Engineers Australia — is now accepting bookings, and promises a stimulating and innovative program for people wishing to get up to speed with, or remain on top of this vital aspect of today's technology.

The conference organising committee has reviewed all the proposed papers and has chosen over 40 for full presentation, and some 15 for poster sessions. Contributions were invited from academia, government and industry-based researchers, and will cover themes such as microelectronics manufacture, circuit design, device technology, opto-electronics and sensors.

To set the conference discussions in the context of Australia's industry policy, the invited keynote opening address comes from Dr Ockert Van Zyl, Executive Director of Siemens Ltd. He is a passionate advocate for Australia's competitive strengths within the worldwide Siemens network, now covering 190 nations, and has succeeded over recent years in persuading his organisation to establish here in Australia three centres of excellence in telecommunications, responsible for worldwide activities or for the Asia/Pacific region.

For enquiries or booking details, please contact the IREE Society; phone (02) 9929 0099, fax (02) 9929 0587, e-mail **ireesoc@ozemail.com.au**, or the web site at **http://www.ozemail.com.au/~ireesoc**.

NEWS BRIEFS

- The Westin Stamford and Westin Plaza in Singapore is hosting ***EMC ASIA 1997***, the first international exhibition and convention with workshops on electromagnetic compatibility. Dates are November 4 to 6, 1997. Details on http://www.mesago.de.
- The annual conference of The Australian and New Zealand Solar Energy Society ***Solar'97*** will be held in Canberra, from 1st to 3rd December 1997. For more information contact Solar'97, PO Box 1402, Dee Why 2099; phone (02) 9311 0003.
- ***Java@Work***, a conference showcasing the latest in Java tools and technologies will be held between September 10 and 11 at the Sydney Convention Centre. For more information contact Softbank Forums on (02) 9211 7467.❖

NEW SPECTRUM REGULATOR

On 1 July 1997 a new regulator for telecommunications and radiocommunications — the Australian Communications Authority (ACA) — was formed through the merger of the former Australian Telecommunications Authority (Austel) and the Spectrum Management Agency (SMA). The ACA will oversee the new era in telecommunications and facilitate access to and use of the radio frequency spectrum.

The ACA's telecommunications licensing responsibilities will include requirements for telecommunications carriers to adhere to appropriate standards in relation to the technical quality of their services, call charging and for billing. The ACA will also administer legislative provisions relating to powers and immunities of carriers in constructing facilities.

The ACA will facilitate access to the radio frequency spectrum through licensing of services, managing radio interference and regulating industry compliance with mandatory standards and conditions. In carrying out this responsibility the ACA will seek to resolve competing interests for spectrum access through auctions and technical allocation schemes, designed to assist consumers and industry take maximum advantage of the social and economic opportunities presented by current and future radio technologies. ❖

IS YOUR COMPUTER MONITOR DESTROYING TREES?

When DOS ruled the computer world and that was all there was, the standard-sized computer screen was OK. But now that graphical user interfaces are the norm, the author of this article argues, these screens may be too small for the good of the world's forests. That's why so many of us print things out, he explains...

by HUGH CLEVERLY

The paperless office has not come about. The idea that computers would reduce the amount of paper we use has not become a reality. In fact the consumption of paper has gone UP, since computers have taken up residence on more and more business desktops and home computer tables.

Why is this so? Business and personal data can be stored electronically on disk, not on paper in drawer after drawer inside filing cabinets. To a large extent this has happened. Businesses, students and other personal computer users do store a lot of their data on their hard disks. The wise user backs up all this data, to whatever type of media they choose from the range now available for that very necessary purpose.

But *still* the use of paper has increased.

It is possible to send business communications, that is letters, electronically. But not every potential recipient has an e-mail connection. So most businesses and nearly all personal letters are still sent on paper, by 'snail mail'. Legal and security considerations may well provide more reasons to continue the use of paper rather than push for more e-mail use, even if it is a little cheaper.

Before people used computers, they had two choices when they sent a letter. They wrote either with a pen or with a typewriter. For those of us with no access to a secretary, the knowledge that correcting an error was such a chore, whether typed or hand written, had its effects.

Firstly a great deal more care was taken, before you started writing, in thinking about what you were going to write. Secondly if you made a mistake you had to decide if a correction with a pen or Liquid Paper was acceptable, or if the recipient warranted starting all over again to try and get a mistake free result. Errors in subsequent drafts tended more and more to be corrected by hand, with or without Liquid Paper.

Many personal computers have been sold with nominal 14-inch (35.5cm) monitors. The author argues that while these may have been fine in the days of DOS and character-based word processors, they're far too small for reading text on a GUI-based system. Is that why so many people print things out to read them?

This all consumed paper. But not as much, it seems, as we do in the computer age. Why not?

The computer makes it so easy to correct mistakes on screen. The layout or design or spelling or paragraph order, or in fact any aspect of a letter or document, can be changed with ease. There's no longer any need for multiple drafts on paper, is there? Well — yes! It seems as though there is a tend to *more* drafts on paper. But why?

It is so difficult to get a clear impression of what a completed document will look like using the standard size of computer screen. You can see only about a third to a half of an A4 page at a time and still be able to read the text. Clicking your way down a document gives you a clear view of only a restricted part of a page. Each chunk you click into view seems to exist as a separate entity and can never be read joined up to

the rest of the page. There is no way to see the clear detailed overview you get from viewing a whole page at a time at real size, or close to real size.

Going to 'Print Preview' mode gives you a graphical representation of the page, but on a normal monitor you generally can't read the words. So any area of doubt that you need to check has to be viewed by zooming in, or by going back to 'Normal' or so called 'Page View'. Any corrections you make then have to be viewed back in 'Page Preview' mode to see if what you have done has effected any other part of the document. And so on, back and forth...

How much easier it is to send the document to a printer and look at the result on several pieces of paper. After all, that's where it's going to end up, isn't it?

Then the corrections can be done back on the computer screen. Print out again, do some more editing. Print out, fine tune. Print out again and so on. Isn't that what really happens?

Why is it so difficult to assess a document by reading it on a computer screen? Because the standard 14" (35.5cm) screen is just too small.

Don't forget that a survey of computer screens has revealed that most so-called 14" monitors have a useful size of far less than this. The 14" refers to the length of the diagonal of screen. The nominal 14" monitor I am using to write this has an exposed glass area which has a diagonal of only 13" (33cm). So the picture can never be bigger than that. In fact, if I accept some slight barrel distortion, the biggest usable picture diagonal I can measure is about 12.8" (32.5cm).

Most people seem to use a screen resolution of 640 by 480 pixels, which is what my screen is set to. I have measured the sizes that a page is displayed in a few word processing programmes. The zoom function was used to display a page so that its width, with margins, just filled up the horizontal space that the programme provided.

An A4 page in Claris Works is displayed as 27cm wide if I use a 110% zoom factor, and at that setting 10-point text is readable. The A4 page, measuring 29.7cm by 21cm has a ratio of its sides of 1.4143:1. Claris Works displays the page as being 27cm wide so the height of the page, if you could see all of it, would be about 38.16cm. Adding the 5cm of tool bars that Claris Works uses at 640 x 480 resolution would require a screen height of 43.18cm, to display a whole A4 page and all the other bits that make up the computer display.

Using Microsoft Works requires a zoom factor of 70% to fill the space horizontally and the width of the page is 23cm, but 10pt text is not readable. The page height at this setting would be (23 x 1.4143), or 32.52cm. Since 10pt text is not readable this size is too small. This setting uses a 70% zoom factor, so at 100%, when 10pt text is readable, the page height would be 46.4cm. Adding the Works tool bars, etc. of 6cm gives a screen height of 52.4cm.

Using MS Word requires a zoom setting of 74% to fill the space horizontally and then the page width is displayed as 24.5cm. The page height at this setting would be 34.65cm, but at this setting 10pt text is again not readable. If this setting used a zoom factor of 74% then at 100%, when 10pt text is readable, the page height would be 46.7cm. Adding the 7cm for Word tool bars etc. gives a screen height of 53.7cm.

For the above examples all programmes were set with documents at the maximum window size.

This suggests that at the resolution of 640 by 480, which most people are now used to, we would need a monitor screen height of between 40cm and 54cm to see a whole page at a time and be able to see all the tools and menu

bars. So the overall screen dimensions would average out at about 27 x 48cm.

At work I use a non-linear digital editing setup which has two 20" (50.8cm) monitors attached to a Macintosh computer. These monitors have an exposed glass diagonal of 19" (48.3cm), and a usable diagonal of 46cm. Occasionally I use a word processing programme on one of the screens, mostly to cut and paste text into a graphics programme. Using a resolution of 1152 x 870, I can see a document at almost a whole page at a time, and 10pt text is just about readable with careful font selection.

It makes such an enormous difference to be able to see a whole page at a time. When I go back to the IBM type PC at my office desk, I find it very uncomfortable and tiring to read from a standard sized monitor, and have taken to printing out any document that I receive electronically if it requires careful reading. Many other people tell me they feel the same.

I am sure that this is not because reading from a monitor is more difficult than reading from a printed page; it's because of the frustration of not being able to see a whole page at a time. We are used to assessing the overall effect of a page and then reading the details. We scan the paragraphs to see what they contain and then read the details. You can't do this anything like as easily or quickly with a computer screen.

This is particularly true if you use 'normal' view, which does not give you a view of a page with margins and page breaks shown graphically. The seemingly endless scrolling screen of text with just a dotted line to show page breaks cannot portray the same information as a printed page.

I am sure that this is why people print out a lot of computer documents and so increase the use of paper. Anything that makes a computer easier to use and provides users with less reason to print out documents unnecessarily surely deserves careful consideration.

There is another aspect of reading from computer screens that provides me with an annoying problem. When reading or working on a particular page, I often want to refer to something on a previous page. With printed text it is easy to scan through the previous pages, find the information I want and look at both pages side by side. Even in a book or magazine it is relatively easy to hold the pages in such a way that your eyes can scan from one page to the other quite quickly.

Using a computer display it is almost impossible to do that. You can scroll back to the information you want to look at, but then you have lost your place in the document you are reading.

Do you highlight the information you are referring to, copy it to the clip board, try to find your way back to the page or part of the page you were reading, paste the information into that page, do your comparison or checking and then delete the information you have just pasted? Or do you open a second copy of the document you are reading, go to the page you want to check and use the area at the bottom of the 'Window' menu to toggle between the two?

If the information you are checking is detailed and the differences between the two are subtle, then this is not satisfactory. Getting two parts of the same document open and viewable at the same time by splitting the screen is not possible with all word processing programmes. Even when it is possible, the small amount of each document in view at a time makes comparing the two a less-than-satisfactory operation.

There is a problem with the size of today's computer screens. I'm not saying that we should all throw away our so-called 14" monitors and replace them with 20" (50.8cm) models. While this would be an ideal solution for some, it would be very expensive.

Flat panel video displays to replace the cathode ray tube are already being produced, but at a price. Wouldn't it be great if far-sighted manufacturers decided that the replacement for our 14" CRT monitors was not to be a 14" flat screen display, but a flat screen display with the dimensions that would show a real size or close to real size representation of an A4 sheet, with enough resolution to clearly read 10pt text.

Most of the millions of computer users worldwide are now used to a screen resolution of 640 by 480 pixels. If we take the screen size of 27 x 48cm suggested earlier for the display of whole pages, the screen resolution would need to be about 640 x 1212 pixels.

If by some miracle my suggested screen size did become the standard computer screen, the vast numbers needed would bring the price down to a reasonable amount from the very high prices being quoted at present, and I'm convinced less paper would be used.

The screen size of 27 x 48cm just happens to give an aspect ratio of 1:1.777777, which is the very same as that of 16 x 9 high definition TV (HDTV). We are told that a convergence of computer and entertainment technologies is coming about. That convergence must require an interchangeability of displays. So a display that provided a far better way to view computer output and had the same aspect ratio as HDTV would find a double market; computer and video.

But of course it would have to have the electronics to display video in horizontal format when turned on its side, and have the resolution to display HDTV. That resolution appears to be about twice that needed for the whole page display suggested earlier, so it will be a bit of a challenge for designers. But if it commanded a huge potential market and saved paper as well, it would be ecologically sound and so be unstoppable as a consumer product.

What would be really handy is to have a display that could show *two* A4 pages, side by side. You could be working on one page, on the right or the left of the screen to your preference, and be able to view any other page on the other half of the screen.

If the HDTV resolution can be economically achieved, then it should be possible. That might be asking a bit much for domestic use, but it would be a great device for business, scientific and design use. ❖

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Solid State Update

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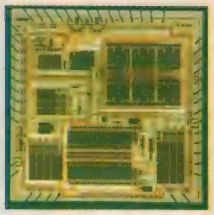


Compact 60A bridge rectifier

The new UPI single phase bridge rectifier assembly from Westek Industrial Products has a rating of 60A and peak reverse voltages selectable from 50V to 1000V.

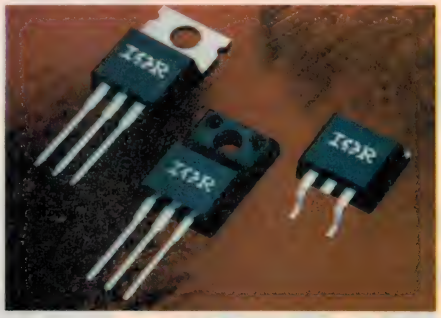
The device can withstand a 1000A surge, has a dielectric strength of 2500V, a low reverse leakage current, and avalanche characteristics that effectively extend the voltage rating. An integral metal heat sink facilitates conduction cooling. A centre through-hole permits rapid chassis mounting and wiring is done with 0.25 inch quick-connect terminals.

For further information circle 274 on the reader service coupon or contact Westek Industrial Products P/L, Unit 2, 6-10 Maria Street, Laverton North 3026; phone (03) 9369 8802.

150V MOSFET with 42mΩ on-resistance

International Rectifier has added 75V and 150V devices to its range of HEXFET power MOSFETs. The new transistors are said to allow components to be more accurately matched to applications in both 24V and 48V input DC/DC power supplies and uninterruptible power supplies.

The devices have on-resistance specifications of 13 milliohms for the 75V IRF2807 and 42 milliohms for the 150V IRF3415, giving improved power conversion efficiency and reduced heatsinking requirements. They also feature a high avalanche rating.



The IRF2807 devices have been designed specifically for 24V battery applications, with the IRF3415 transistors aimed at similar 48V uses. Because of the low on-resistance, it's claimed fewer devices connected in parallel will be needed in an application, along with smaller heatsinks. The devices are also said to allow the power output level of an existing design to be upgraded.

For further information circle 277 on the reader service coupon or contact Hartec Ltd, PO Box 264, Box Hill 3128; phone (03) 9268 9000, free call 1800 335 623.

Tiny 3V photomodules

A new family of miniaturised photomodules that operate from a 3V supply has been released by TEMIC Semiconductors. The new TSOP18XX family is suitable for use in remote controls, VCRs, audio equipment, satellite receivers, set-top boxes, security, DVD and stereo systems. The devices come in a package 8mm high and 5.5mm thick and integrate a photo detector and preamplifier IC for intelligent automatic gain control. No additional components are needed for complete functional compatibility with a microcontroller.

The devices are said to offer improved shielding against electrical field disturbances and ambient light without needing external shielding components. The photomodules are available in seven versions to match carrier frequencies from 30 to 56kHz. Each version supports all major transmission codes, including RC5 and RECS80.

For further information circle 276 on the reader service coupon or contact Braemac Pty Ltd, 1/59-61 Burrows Road, Alexandria 2015; phone (02) 9550 6600.

True orange LED indicators

The Electronic Products Group of Dialight Corporation has developed a new line of 3mm high efficiency LED circuit board indicators said to provide a bright, uniform colour that is distinctly orange.

The new indicators are available in a wide range of configurations, including single level, bi-level, bi-level arrays, tri-level, and quad-level versions. Also available are DIN 41494-compatible indicators in single, bi-level, and tri-level versions. The orange LEDs have a wavelength of 600nm, a light output of 6.5mcd, and a forward voltage of 2.2V at 10mA. Viewing angle is +/-30 degrees. Diffused and tinted and non-diffused versions are also available.

Black housings ensure proper alignment, and provide resistance against shock and vibration as well as enhanced contrast for improved viewing. Standoffs on the housings facilitate circuit board cleaning.

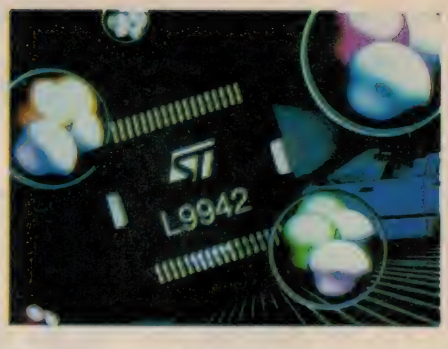
For further information circle 280 on the reader service coupon or contact Dialight Corporation, 1913 Atlantic Avenue, Manasquan, NJ 08736; phone (908) 223 9400, fax (908) 223 8788.

IC for automotive doorlock systems

The new SGS-Thomson Microelectronics L9942 integrated circuit combines on one chip all the functions needed to control and drive a doorlock actuator motor. It interfaces directly to a controller area network (CAN) bus. Included on the chip are an ST6 8-bit microcomputer core, EPROM program memory, a CAN protocol handler, a line interface, a voltage regulator, contact monitors and a H-bridge power stage capable of delivering up to 4A. The IC can be housed inside the actuator case.

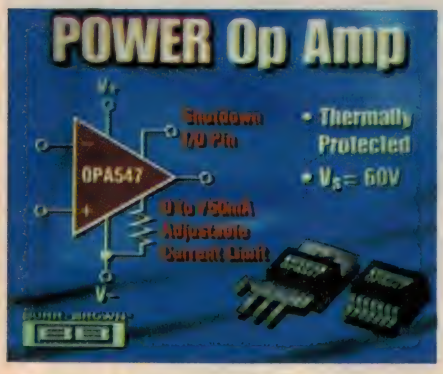
According to the company, studies have shown that 60% of the cost of an automotive system today is in the connectors, boards and passive components, yet these are the cause of most failures. The new IC is said to reduce the number of these parts, and to therefore lower costs and increase reliability. The device is based on the company's third-generation bipolar CMOS DMOS (BCD3) technology.

For further information circle 278 on the reader service coupon or contact



SGS-Thomson Microelectronics, Suite 3, Level 7, 43 Bridge Street, Hurstville 2220; phone (02) 9580 3811.

Op-amp has adjustable current limit



Burr-Brown's new OPA547 is a low cost, high-voltage, high-current operational amplifier designed to drive a wide variety of loads. It operates from either single or dual supplies up to +60V (+/-30V) and is internally protected against current overload and over-temperature conditions. It also has an enable/status pin which disables the output and indicates if the device is in thermal shutdown. Applications include industrial control, test equipment, power supplies and audio amplifiers.

The op-amp provides an accurate, user-selected current limit (0 to 750mA), by sensing the output current indirectly. This allows the current limit to be programmed with a 0 to 150uA control signal achieved with a resistor/potentiometer or controlled digitally with a DAC.

Specifications include 100dB power supply rejection, 95dB common-mode rejection and an open-loop gain of 115dB. Voltage output swing is to within 800mV of the negative rail and to within 1.5V of the positive rail at 100mA output.

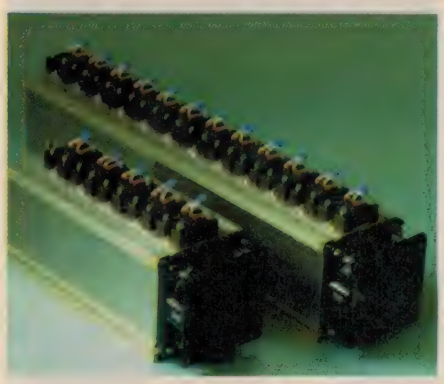
For further information circle 279 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 9878 2700.

80A solid state relay assembly

Novatherm now has a range of solid state relay assemblies said to offer a reliable alternative to conventional switches and contactors. The assemblies comprise a solid state relay (or relays), heatsink, a cooling fan (if required) and transient voltage protection.

They are ideally suited to heating applications and are claimed to give a much longer service life than electromechanical switches, particularly where high switching rates are involved.

When used with a time proportioning PID temperature controller, the



assemblies also give improved control because the proportional cycle time can be set to switch the relay rapidly, resulting in reduced hysteresis and temperature fluctuations about the set-point.

The assemblies have a rugged heat sink design and metal oxide varistors are provided as protection against voltage transients, with RC snubbers offered as an option. They are available in current ratings up to 80A and in single and three phase versions. Custom assemblies can be built on request.

For further information circle 273 on the reader service coupon or contact Practical Control Solutions P/L, PO Box 1052, Mount Waverley Delivery Centre, Mount Waverley 3149; phone (03) 9803 1878.

IC for CCD video

EXAR Corporation has announced two single-chip, low power, analog image signal processors for charged coupled device (CCD) video and imaging applications. The XRD4460 operates at 5V, and the XRD44L60 is optimised for 3V operation. The devices digitise images in video camcorders, video cameras, digital still cameras and copiers, as well as document and film scanners, before the image goes to a digital signal processor (DSP) or digital post processor.

The chip includes a correlated double

sample and hold (CDS), a programmable gain amplifier (from two to 80), a low-power 10-bit analog to digital converter, and automatic offset calibration. The PGA and offset calibration codes are controlled through a simple serial interface. The device also features differential or single input options, power down, and a 15MHz sampling rate when operated at 3V and a three-state digital output.

For further information circle 281 on the reader service coupon or contact EXAR Corporation, 48720 Kato Road, Fremont, CA 94538; phone (510) 668 7000, fax (510) 668 7017. Web site: **http://www.exar.com.** ❖

NEW PRODUCTS

EMC tester is easy to use

The new Schaffner Best Plus is a single package EMC test system for full compliance testing of industrial as well as residential and commercial equipment. It combines in one instrument a multi-function generator providing burst (to 2.2kV/100kHz), electromagnetic discharge (to 8.8kV ESD), surge (to 2.2kV/1100A) and power quality pulses (for power line and data line compliance), ground plane, cables, ground strap, grounding resistor and coupling clamp for data line testing.

Test options also include power frequency magnetic field testing (to 30A/m) and pulsed magnetic field testing (to 1100Nm, using 1.2/50 pulses) as well as upgrades to full IEC level 4 specifications.

The instrument has a universal interface/coupler to connect to the product being tested, and pre-programmed tests using built-in test pulses can run a compliance testing procedure with all signal generation functions controlled from a front panel, or from a PC running Windows-based software.

For further information circle 249 on the reader service coupon or contact Westek Industrial Products P/L, Unit 2, 6-10 Maria Street, Laverton North 3026; phone (03) 9369 8802.

Data logger with PCMCIA SRAM card

The New Hioki 8806 memory/real time recorder with logging function features a PCMCIA compatible SRAM card for permanent data storage, and is suitable for field use. Applications include power quality monitoring, maintenance tasks on power electronics, PLCs and other industrial equipment. The instrument can record two analog and eight digital signals simultaneously, and its high recording speed allows it to capture transients. It has a footprint of 245mm x 106mm and can be powered via an AC adaptor or batteries.

The two analog channels have 450V peak AC/DC isolation and can measure a 240 volt AC line without needing a transformer. A range of current clamps is available up to 1000A. The recorder has a 64K word memory, and the PCMCIA compatible SRAM card can save data in BMP, binary or text format. It has a 74mm wide thermal printer for recording time and vertical axis units as well as X-Y plots, and a backlit 20mm LCD with scalable cursors for time and vertical axis read-out. The instrument has a maximum sampling speed of 400kS/s, and calculation functions include peak-to-peak, average, area and effective (RMS) values for recording RMS voltage and current levels on 50/60Hz power lines.

For further information circle 248 on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066; phone (03) 9419 9999, freecall 1800 623 350.

DSO has colour display

The 6000 digital storage oscilloscope from Gould Instrument Systems has been upgraded and now includes a full colour display, 50k memory, fast Fourier transform (FFT) and pulse width triggering. With the colour display, channel annotation and ground markers are colour matched to the traces to which they refer.

The scope has four channels, a 200MHz bandwidth, live waveform processing, user defined channel scaling and TruTrace, a patented compression technique which generates a variable intensity display similar to that produced by an analog real-time oscilloscope.

For further information circle 241 on the reader service coupon or contact Scientific Devices Australia, PO Box 163, Oakleigh M.D.C. 3166; phone (03) 9569 1366.

Power meter suits inverters

The new Hioki model 3330 power meter covers power consumption measurements from 30 watts to 18 kilowatts and has an energy range to 999,999MWhr. The meter measures currents up to 30A without a CT or shunt. Voltage is measured over three ranges: 150, 300 and 600V. The instrument has a bandwidth from 10Hz to 50kHz, allowing it to measure power output from an inverter or a switch-mode power supply.

The instrument also measures frequency over the full bandwidth range. An in-built comparator function allows it to be adapted to assembly line operations and automatic testing (ATE). This function is further enhanced through optional RS232 and GP-IB interfaces. It has a basic accuracy of +/-0.3% and a response time of 0.4 seconds, making the instrument suitable for transient measurements.

For further information circle 245 on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066; phone (03) 9419 9999, freecall 1800 623 350.

Leakproof photoelectric sensors

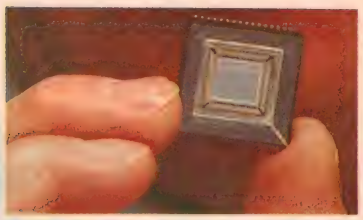
Banner Engineering has announced the Q10 series of miniature, self-contained 10 to 30V DC photoelectric sensors. These right-angle sensors are claimed to be extremely rugged relative to their small size, and feature 10mm thick housings. The narrow design allows them to be mounted in very tight spaces using the stainless steel bracket and hardware supplied with each unit.

The sensors have black ABS housings and completely sealed, epoxy encapsulated circuitry. The glass lenses are hermetically sealed, making the sensors leakproof. They are also electrically protected against reverse polarity, false pulse on power-up and continuous overload or short circuit of the outputs.

Sensing modes and ranges include diffuse models with a 0.5m range, and opposed models with a 1.8m range. Diffuse models feature a top-mounted sensitivity control to adjust system gain (sensing power). NPN (sinking) or PNP (sourcing) outputs, as well as light or dark operation can be specified. Dual LEDs indicate power on and light sensed, and flash to indicate an overloaded output and marginal excess gain in the light condition.

For further information circle 249 on the reader service coupon or contact Micromax P/L, 307 Keira Street, Wollongong 2500; phone 1300 362 626. ❖

Silicon Valley NEWSLETTER



Intel to produce 'Socket 7' Pentium II

Intel appears to have back-pedalled somewhat, with the announcement that in 1998 it will launch a Pentium II chip for portable computers based on the standard 'Socket 7' system architecture. Intel officials confirmed engineers are working on a redesign of the package of the Pentium II so it will fit into a standard Socket 7 format board. The company is also taking aim at the market for inexpensive portable computers, with a new 120MHz low-power chip scheduled for availability later this year.

Up to a third of all PC microprocessors go into portable computing devices, and Intel hopes the two new chips will help prevent that market from falling completely to Advanced Micro Devices, Cyrix, and Integrated Device Technology. Inexpensive, low-power chips from these chipmakers are effectively targeting this market segment, which is growing faster than any other processor segment.

Analysts said the move is the clearest indication to date how badly Intel has misjudged its competitive position, when it decided to drop the Socket 7 architecture. The company, which hasn't experienced any competition in the high end of the processor market for more than a decade, appeared to have completely underestimated the ability of AMD, Cyrix and others to bring chips to market that could compete head-on with Intel's best. Intel opened the door to competition wide open when it abandoned the Socket 7 architecture, expecting the systems market to blindly follow its prescription for system architecture for the next generations of PCs.

Rather than acknowledging the forced retreat to Socket 7, Intel spokesman Howard High emphasized that "We feel that we will be very competitive in the mobile processor market".

The 120MHz Pentium chip will be available in the fourth quarter and cost around US$106 per chip. That would put it in the same price range as Cyrix's Media GX which costs just under $100. The latter, however comes with a built-in graphics processor, making the overall package still much cheaper than the Pentium chip.

The Pentium II chip won't be available until some time next year, another indication that the product comes in reaction to market developments Intel had not foreseen.

Supercomputers banned from 13 organisations

Scientists working for 13 organizations involved in nuclear weapons research will have a much tougher time getting their hands on state-of-the-art supercomputers, following a decision by the Clinton Administration to put those groups, including six in China and Russia, on an export blacklist. The list, which also includes groups in India, Pakistan and Israel, is expected to get longer in the months to come, according to Administration officials.

The move comes after the sale of high-end graphics supercomputers from IBM and Silicon Graphics to several of Russia's top nuclear weapons research facilities. They were able to use relatively simple deception schemes to take advantage of relaxed export control laws and purchase advanced computers.

Topping the blacklist is the All-Russian Scientific Research Institute of Technical Physics, a front organization for Russia's top nuclear weapons lab. Earlier this year, the Lab proudly announced it had been able to purchase the machines, to be used in nuclear blast simulations, by making Silicon Graphics officials belief the equipment would be used for environmental research.

Compaq buys Tandem

Tandem, the Silicon Valley company that pioneered the fault-tolerant computer system architecture that is the basis of today's global online transaction processing industry, has agreed to be acquired by Compaq in a deal valued at US$3 billion.

Compaq, which is seeking to develop itself beyond a manufacturer of desktop systems, plans to use Tandem to offer

Derrick Rowe, president and CEO of Stratos Mobile Networks, presents a mini-M satellite phone to HRH The Duke of Edinburgh (R), to commemorate the first official call launching the satellite communications service to the Hibernia Platform, in St. Johns, Newfoundland. The Duke placed the first official call on June 25, to Ken Compton on the Hibernia Platform. (Business Wire)

large organisations one-stop computer network solutions in which its desktop computers are connected to Tandem-based servers and gain access to Tandem's powerful Windows NT-based network database software. The acquisition will be a key piece in Compaq's ability to realize its goal of doubling annual revenues to around US$36 billion in the next couple of years. Compaq chief Eckhard Pfeiffer said he sees the potential all-in-one computer market doubling to a stunning $650 billion, of which his company hopes to grab a sizable chunk.

Last year, Tandem had US$1.9 billion in sales and employed 7000 employees. Tandem recently unveiled new database software that lets companies process their biggest and most critical files on relatively inexpensive computers such as Compaq's, under the Windows NT operating system. Other products include data security systems for transactions with banks and retailers.

Compaq's US sales of PCs grew 31.9% in the first quarter of this year — but that was less than half the growth rate of top challenger Dell Computer.

12 firms launch Intel/Microsoft Net PCs

A dozen major PC manufacturers including Compaq, IBM, and Dell have launched network computers based on the Net PC design promoted by Intel and Microsoft. The systems, most of which will be available in the third quarter, are an attempt by the manufacturers to offer their customers a competitive alternative to putting an expensive full-blown personal computer on employee desks.

Orchestrated by Intel, the move also deals a blow to Oracle's effort to establish its NC architecture as an industry standard. The Net PCs will retail for US$1000 - $1500 compared to around $2500 - $3500 for the average corporate multimedia PC. More significantly, the Net PCs have an overall cost of ownership that is a fraction of the US$8000 - $12,000 average which PCs require over their three to four year life cycle.

Among the Net PC makers, Dell Computer has demonstrated two prototypes, one featuring a Pentium 233MHz processor with MMX technology and a second with a Pentium II at 266MHz.

Unlike the NC proposed by Oracle, the Intel-based NCs generally feature an internal local hard disk drive, but no floppy or CD-ROM drive. The systems all incorporate Intel's Wired for Management technology, which lets network managers configure systems remotely, install software upgrades, maintain the network during off hours and diagnose problems remotely.

Other companies showing prototype NCs were Compaq, Hewlett-Packard, Acer, Gateway 2000, IBM, Mitac, Mitsubishi Electric PC, NEC Computer Systems, Pionex Technologies, Unisys and Zenith Data Systems.

Workstations boom, driven by Windows NT

The market for workstations grew at an explosive 30% rate in the first quarter of 1997, driven largely by the current momentum behind Wintel-based workstations that run the Windows NT operating system on Intel-based systems. Dataquest in San Jose said that Windows NT-based workstations saw a 242% jump in sales in the first three months when compared to the same period in 1996.

NT-based machines accounted for 12.6% of the workstation market, with Unix machines continuing to control 86%. But NT-based workstations, which are generally much less expensive than their Unix counterparts, accounted for 23.6% of nearly 250,000 workstations shipped in the period. Together, the Unix-based machines accounted for US$3 billion in sales.

In the Windows NT workstation market, Hewlett-Packard was the leading vendor with 22,898 units or 37.3% of the total but was number three in revenues with 23.5% of the market. Intergraph Group led in total revenues with US$113 million, or 25.3% of the market, although it was fourth in units with 7586 or 12.4%. Compaq was second in both Windows NT units shipped (17,811) and accounting for 29% of industry shipments in the first quarter and revenues of US$107 million, or 24.9%. Digital Equipment ranked third in volume of NT workstations with 8824, or 14.4%, and fourth in revenues with US$78 million, or 18.1%.

Dataquest analyst Peter Foulkes said the trend towards growing marketshare for NT workstations will continue for the foreseeable future, as powerful Intel processors are now performance-competitive with RISC-based chips. "With the introduction of Pentium Pro, Intel-based systems could complete on an equal footing with entry-level RISC systems, accelerating the penetration of Windows NT into the Unix-dominated workstation market."

Motorola takes aim at Teledesic

Motorola is to expand its satellite-based communications service business with a newly planned US$12.9 billion constellation of 63 satellites, that will offer business users such as broadcasters, telecommunications firms and globally dispersed corporations high-speed data and video transmission services.

The Celestri service will be the third satellite venture for Motorola, which earlier launched the US$5 billion Iridium wireless telephone and pager network and the $6.1 billion M-Star high-bandwidth system that will provide data transmission to corporations. The company's plans call for satellites to be launched starting in 2001, with service starting around 2003.

Celestri will compete head-on with Teledesic, the company co-founded by Microsoft chief Bill Gates and cellular telephone industry pioneer Craig McCaw. Teledesic is planning to build 'an Internet in the sky' network of 288 satellites at a cost of US$9 billion. Teledesic hopes to start service in 2002.

Motorola has asked the US Federal Communications Commission for permission to transmit on the same frequency as Teledesic is planning to use.

Myron Wagner, VP and director of engineering for Motorola's Advanced Systems Division, said the company hopes to sell Celestri services to phone companies, businesses and ultimately consumers. "We really are trying to offer a full range of services to a very broad set of customers. This service will be 100 to 1000 times faster than typical Internet access, and we believe it will have a tremendous number of applications."

Terminals will range in price from hundreds of thousands of dollars for telecommunications companies to just US$750 for a consumer, he said.

Novellus counters with suit against Applied

Will chip equipment maker Novellus have the last laugh in the bitter competitive feud with industry leader Applied Materials?

Novellus recently agreed to pay Applied US$80 million to settle a patent infringement case it had lost in court, but has now filed a similar lawsuit accusing Applied of illegally incorporating Novellus' technology into its popular Endura and Centura PVD (physical vapour deposition) systems.

Novellus is asking the court for unspecified damages for infringing sales and punitive damages for willful infringement. The company also seeks an injunction to keep Applied from selling the systems in question.

Novellus recently acquired the patents in question from Varian Associates, when it purchased Varian's Thin Film Systems business. ❖

Product review:

DAQSCOPE 5102 20MS/s SCOPE CARD

National Instruments' latest addition to their range of computer-driven test equipment is the DAQscope 5102, a digital oscilloscope card for the PC that offers a sampling rate of 20MS/s over two 8-bit channels. It's compatible with NI's own VirtualBench software package, as well as the popular LabVIEW and LabWindows/CVI instrumentation packages.

by GRAHAM CATTLEY

Putting an oscilloscope inside a personal computer would seem at first to be a strange idea, as the average desktop computer must be one of the most electrically noisy environments you are likely to find. Surprisingly, National Instruments have taken such considerations in their stride, and have released over the years a range of ISA and PCI card-based instruments that can slot into almost any PC on the market.

The DAQScope 5102 is the latest of these cards, offering quite reasonable performance. Two channel 8-bit measurements are possible, with both channels able to support a sampling rate of 20MS/s simultaneously, and an input bandwidth of 15MHz. Despite its environment, the scope's noise level is quoted at +/-0.5 LSB RMS. These figures may not be pushing the limits of current scope technology, but this card is certainly on an equal footing with other self-contained scopes on the market.

Available in ISA, PCI and even PCMCIA card versions, the DAQScope can be driven by a number of different software packages offering data acquisition and control functions, and the software drivers to interface to the card are available so that you can also use the DAQScope in your own applications.

For this review, we decided to look at the ISA version, as none of our lab machines had PCI busses. The DAQScope AT-5102 has the standard 16-bit AT form factor, with a steel shielding plate mounted over the more sensitive components in the front end. The end mounting plate contains three standard BNC sockets (one for each input and one for the external trigger input), as well as a pair of SMB 100 miniature RF connectors used to link various DAQ cards together, and to provide a number of software selectable outputs.

The ISA version performs data transfers through normal I/O ports while the PCI version can support a direct-to-memory data transfer via the bus. However both types of card contain a 663k sample buffer, so you shouldn't notice any difference between them in operation.

The software...

Having opened the box containing the DAQScope, I was confronted by the DAQScope card itself, a pair of x10 scope probes, and an SMB to BNC converter cable. Things started to get confusing though as I opened up the package of software. Inside I found a User manual, a 'getting started' booklet for VirtualBench software, two release note pamphlets and *two* CD ROMs. As well there was a small plastic bag that contained four floppy disks, labeled *DAQScope Instrument Drivers V1.0.*

Unsure as to which software needed to be installed (surely you don't need to install *two* CDs worth? And why are there drivers on floppy disk?), I ploughed through all the manuals, guides and notes. Eventually I came up with the fact that the board is supplied with a copy of VirtualBench, and that in order to run it, a set of specific drivers would need to be installed so that the application could talk to the card.

Information on installing these drivers was a bit sketchy, so I went ahead and installed VirtualBench off one of the CDs. The installation was fairly uneventful, and I ended up with a new program group containing a number of icons for a variety of different test instruments — including a data logger, spectrum analyser, signal analyser and digital multimeter.

The next step seemed to be to install the drivers for the DAQScope, and so I followed the instructions in the release notes supplied with the CD. Looking through it I found explicit instructions for installing these drivers under Win95 and Windows NT, as well as a lot of help on configuring the card in Plug and Play systems. The Windows 3.11 instructions, however, referred me to the *NI-DAQ User Manual for PC Compatibles* for installation instructions; further reading told me that this manual was an Adobe Acrobat .PDF file, and that this would be installed after I had installed the 3.11 drivers. This smacked of recursion to me, as I couldn't install the drivers until I had the manual, and I couldn't get the manual until I'd installed the drivers...

Need a temp

Installing these drivers can't be *that* hard, I thought, so I tried running the setup program on the root directory of the driver CD. Sure enough, a menu screen popped up allowing me to install either the hardware documentation or the NI-DAQ drivers.

Well, I opted for the documentation, as I seemed to be severely lacking in this department, and was faced with the option of installing the manuals for a list of NI devices — none of them matching the AT-5102. I gave up on that, and selected instead the NI-DAQ installation option from the main menu. After running an Install Wizard, the install program informed me that my temp environment variable wasn't set, and bailed out.

Now I knew that my temp variable *was* set, and even confirmed this by opening a DOS box in Windows and typing 'set'. Getting a little exasperated by this stage, I decided to do something that I rarely do: I called Tech support. The NI Tech Support team were more than happy to help, and they led me through a couple of procedures to see why Windows seemed to forget its temp variable when installing their software.

We went through a couple of procedures to no avail, and so after a couple of returned phone calls they offered to come around to the *EA* offices and see what they could do. As I'd spent the best part of a day and a half trying to get the

The DAQScope AT-5102 is a 15MHz oscilloscope card that can be fitted to your PC. It comes with a kit that includes a pair of x10 scope probes, manuals, and a copy of VirtualBench instrumentation software.

system up and running, I was more than happy to let someone else have a go...

Within 20 minutes of their arrival the next morning, they had everything up and running. It turned out that the install program was case sensitive, and was looking for 'TEMP' rather than 'temp' as was set in my autoexec.bat...

Once this bug was sorted out, they were able to answer a couple of questions that had arisen while I was installing the system. Firstly, yes, the installation instructions for 3.11 were a little recursive, and yes, the system is a little unfriendly to set up. But they are 'working on it', and with any luck a single disk install program would appear that will make installation that much easier.

They were also able to clarify a couple of other points: the manual for the AT-5102 isn't on the disk after all; it consists of just the printed booklet supplied with the card. And the four floppy disks? It turns out that they are the drivers to allow you to write your *own* Windows applications, and have nothing to do with the installation of either the VirtualBench or NI-DAQ software.

Using the DAQScope

Once the Tech Support guy had left, I fired up Windows and ran the first of the instruments in the VirtualBench program group. This was the DAQScope application, and after a short while a small toolbar popped up containing a button for each of the instruments in the program group, as well as a help and exit button.

The buttons for all the instruments except the scope were greyed out, and so I didn't have much choice but to select the DAQScope instrument.

This gives a scope window that can be expanded to full size, and displays both channels on a display that covers three quarters of the screen. The remaining area is given over to three large rotary controls used to set the timebase and the gain of each channel, and a number of buttons to enable various traces including Ch1 and 2, Ref1 and 2, and a 'maths' trace that can show the usual Ch1+Ch2, Ch1-Ch2, etc.

Up to eight waveform measurements can be displayed at the bottom of the screen (including frequency, period peak and RMS values), in addition to a set of cursor measurements giving the time and voltage difference between the two selected points.

The displayed data can be saved in an ASCII text file, to be imported into other applications, or you can select 'Print waveform' which dumps a screen image of the whole scope window to the printer — this doesn't go through Windows normal print requester however, so you don't have any control over the size, scale or format of the image. (All the text in the printout had reverted to a Courier typeface, but with no means of printing to a file, it was hard to tell if the fault lay in the software or the printer.)

The DAQScope software had a few quirks, with little things like measurement labels being cropped by the graticule and button labels running into buttons giving the program a rather unfinished look. But otherwise it performed OK.

Yes, but no...

Having used the scope to make a number of measurements, I thought that I'd try out some of the *other* 'virtual instruments' that were installed. I wanted to do some data logging for an upcoming project, and so I quit back to the VirtualBench program group and double clicked on the data logger icon. Up popped the VirtualBench toolbar again, only it still had all the instruments greyed out with the exception of the scope.

After checking that these other instruments had been installed properly, I phoned Tech Support again. The were most understanding, but explained that although the instruments were actually installed on my system, they were 'switched off' and I would have to pay an extra $395 per instrument to activate them. Nowhere in any of the supplied documentation was this rather important point explained, and as the VirtualBench manual described the operation of all nine instruments, I was rather under the impression that I would actually be able to *use* some of them...

To rub salt into the wound, all of the instruments *had* actually been installed, and a quick check told me that the VirtualBench directory contained over 27MB of data. Add this to the 20MB in the NI-DAQ directory and whatever DLL files were added to Windows' system directory, and I was looking at around 50MB of disk space — all for one oscilloscope application.

All in all, I can't say that I was terribly impressed with the whole setup. I have no doubt that the AT-5102 card performs well and to spec; it's just that the supplied support software leaves a lot to be desired.

There is, I suppose, a good chance that the AT-5102 will be used in a customised application, and so most of the problems I experienced may be irrelevant. But if I had the asking price of $2447 (plus tax) to spend on an oscilloscope, I must say that I'd be looking quite hard at one of the newer portable DSOs (with PC interface) that seem to offer many more features for the money. ❖

DAQScope AT-5102

An ISA card dual-channel oscilloscope that can sample up to 20MS/s real time on both channels simultaneously, with a 15MHz bandwidth. Extra software 'instruments' can be purchased, allowing the card to be used as a number of different test instruments.

Good points: Can sample up to 1GS/s with random repetitive sampling.

Bad points: Expensive, difficult to set up, fills up your hard disk with unusable software.

RRP: $2447 plus 22% sales tax. Extra instruments are available for around $395 each.

Available: National Instruments, PO Box 466, Ringwood, Victoria 3134. Telephone (03) 9879 9422.

SPOTLIGHT ON

SOFTWARE

Electronics Workbench EDA

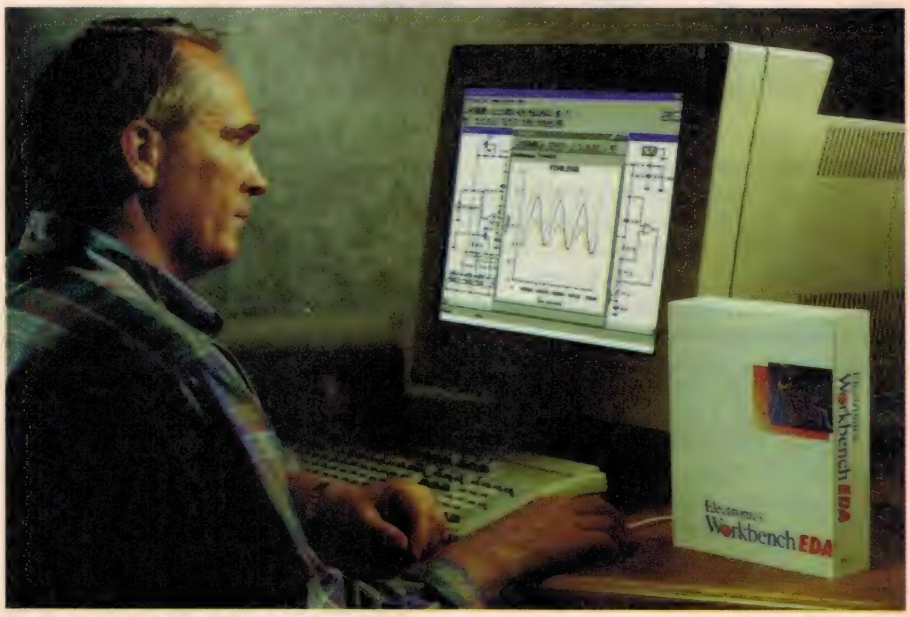
Emona Instruments are now supplying the recently released Electronics Workbench EDA, which offers many improvements over the previous version 4.1 that I reviewed last year. One of the most noticeable and welcome chances has been the inclusion of a range of analysis tools that make this latest version perhaps the best electronics design, development and analysis package that I've come across.

by GRAHAM CATTLEY

Back in July last year I reviewed Electronics Workbench 4.1 and was most impressed with the simple and easy to use interface, that set it apart from almost all other circuit simulation packages on the market. EWB4.1 differed from most other simulation software in that it used 'virtual' pieces of test equipment. These were small icons representing oscilloscopes, meters and other diagnostic tools that could be connected to the circuit and would perform measurements in much the same way as real ones.

This was a revolutionary concept in circuit simulation software, and it gave a very real feel to the process of designing and testing your own circuits. In fact, EWB4.1's whole interface had a realistic feel about it, in that you actually felt that you were constructing a circuit on the screen, rather than just cobbling the component symbols together so that a simulation could be performed.

One of the shortcomings of version 4.1 was that you were limited in your analysis to the measurements that the six available pieces of test equipment could perform, and as a result you were forced to forgo any computer-aided analysis and rely instead in interpreting the readings from the test equipment. As you have probably guessed, Interactive (the company that developed Electronics Workbench) has addressed this issue along with many others, and the result is everything you hoped it would be.



Electronics Workbench EDA offers a range of circuit analysis options that weren't available in the earlier versions. The results of these analyses can be displayed in a separate graph window, as shown above.

New look

Electronics Workbench EDA (EWBEDA) brings with it a new look, but maintains the feel of the previous version. The inclusion of a speed bar with one-click function buttons is a welcome addition, as is the new component selection system. Previously, a 'parts bin' window was opened and the required components were dragged out of it into the work area. This extra window used up valuable screen space, and you tended to pile up the components in the centre of the screen before laying them out and joining them together.

With EWBEDA you just click on one of the parts bin speed buttons, and a pop-up component selection box appears allowing you to drag the selected component directly into place. As the selection box disappears immediately after the component has been selected, you can position it in the circuit directly, without having to shuffle windows around.

The parts themselves have been rearranged into 11 new parts bins, making each component easier to find, and you can move frequently used components into an extra 'favourites' bin for even faster schematic layout. Two other welcome additions are a zoom feature, letting you enlarge sections of circuit by as much as 500%, and the ability to flip and rotate components. This means that you can now draw schematic diagrams that look like the real thing, and not to have to contend with recalcitrant transistors that only sit one way round.

The danger here is that you tend to worry about getting the layout just right, rather than concentrating on the actual design or simulation of the circuit. But this is, I think, a good thing in that it shows that the user is thinking about the circuit, rather than trying to work around the user interface.

Analysis

As I mentioned before, one of the most welcome additions to EWBEDA is

the host of new analysis options available. These include the original DC, AC and transient simulations, along with Fourier analysis, noise, distortion, and transfer function measurements. One of the most useful analysis options (from the circuit design point of view) is the ability to sweep various parameters, including component values and temperature, and graph the result. You can also perform Monte Carlo random component variation analysis as well.

The output from any or all of these analyses can be viewed in a special graph window that stores the results of each analysis as a separate page, making it easy to tab between them. A comprehensive set of measurements can be performed on any of the resulting graphs by using a pair of cursors that can be moved along the graph's X-axis. Each graph can be printed out along with the cursor measurements, and you can edit the graph's properties to include axis labels, a graticule and a listing of the simulation's parameters.

To top it all off, EWBEDA runs on a speedy SPICE 3 simulation engine, and as a result simulation times are significantly reduced from the 4.1 version.

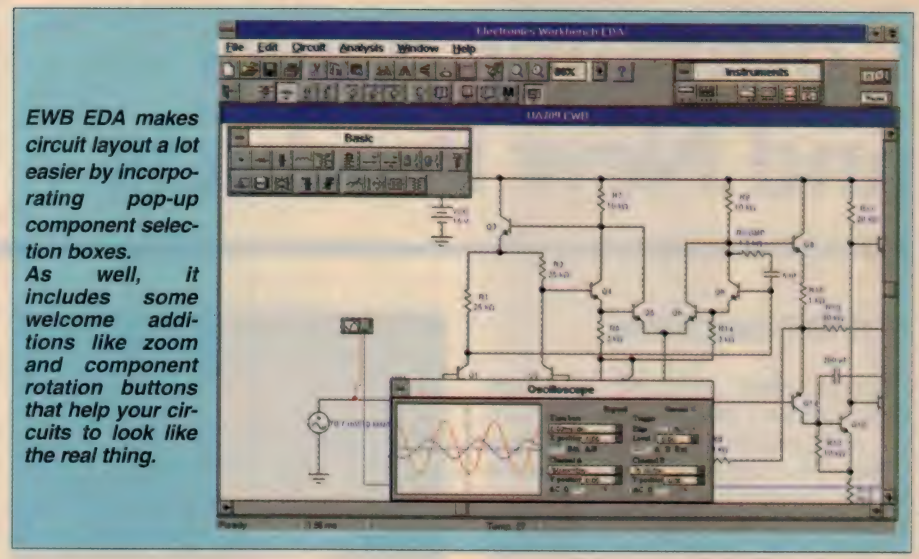
With the addition of these extra analysis options, EWBEDA has ceased being just a circuit simulation package, and has now become a viable practical electronics design tool.

In my review of version 4.1, I said that EWB shouldn't be compared with the likes of Micro-Cap and other circuit analysis programs, as it performed a different function. Well, this is no longer the case. With the new analysis options in version 5, I think that Electronics Workbench EDA will rapidly become the tool of choice in circuit design, as well as in its original purpose in electronics teaching.

And speaking of teaching, I shouldn't forget to mention one of the important facets of EWBEDA: that is, its use in teaching both faultfinding and repair of electronic circuits. The properties of any component in an EWBEDA circuit can be set to simulate a fault condition, with shorts, open circuits etc., selectable between any sets of pins in the device. All the components in the circuit can then be locked, and the student can then be left to use the range of virtual test equipment to find the fault.

What's in the box?

Electronics Workbench EDA is supplied on five floppy disks and comes with a User's Guide, a Technical Reference manual, a guide to exporting netlists and a booklet containing a complete list of the 8000 electronic components that are installed as part of the software. Like the software, all the manuals are professionally produced, with the User's Guide giving step-by-step instructions in using EWBEDA, as well as running through a series of demonstration circuits that you can build on the screen to try out the various features.



EWB EDA makes circuit layout a lot easier by incorporating pop-up component selection boxes. As well, it includes some welcome additions like zoom and component rotation buttons that help your circuits to look like the real thing.

I installed EWBEDA on two different machines, a Win3.11 486DX66 with 16MB, and a 32MB Pentium 150 running Win95. The 486 seemed more than capable of running the simulation software, and although the simulation time was about twice that of the Pentium, I didn't feel as though the software were running slowly; its performance was quite acceptable.

Interactive have dropped the clumsy look-up-a-word-in-the-manual copy protection scheme used in the previous version, and have opted instead for a system of writing your name and company to one of the disks on the first installation. This information is displayed every time you re-install EWBEDA, and is in my mind a more civilised way to go.

You may have noticed that I haven't gone into detail about how to use EWBEDA; this is because it is almost exactly the same as using the previous version 4.1. I covered much of EWB4.1's operation in the July 96 review, and much of it still holds true for EWBEDA. Despite its powerful analysis and simulation functions, EWBEDA is still simple and easy to drive, and doesn't suffer from lots of extra bells and whistles.

They say on the side of the box that you'll be using EWBEDA constructively within 20 minutes, and I can quite believe them. It takes only a couple of hours to explore all of EWBEDA's functions and features, and you'll become quite proficient within a day or so.

If you are interested in trying out EWBEDA, you might like to take a look at Emona Instruments' web site at **http://www.emona.com.au**, where you'll be able to download a demo version of Electronics Workbench EDA, as well as a demo of Electronics Workbench 5. Version 5 differs from the EDA version in that it comes with only 4000 components, and about half the analysis options. It is, however less than a third of the price of EDA ($499, as opposed to $1599), and is more likely to be within the reach of private designers.

There are also a range of upgrade paths available as well, so it's worth getting in touch with Emona if you have an earlier version.

I might sum up this review with the fact that over the year in which I've used EWB4.1, I've developed a small wish list of features and additions that I felt were needed. Suffice it to say that all of these points have been more than addressed in this latest version, and that in the few weeks that I've had reviewing it, Electronics Workbench EDA has come up trumps every time. ❖

Electronics Workbench EDA

Circuit simulation and analysis software, with schematic capture and netlist import/export facilities.

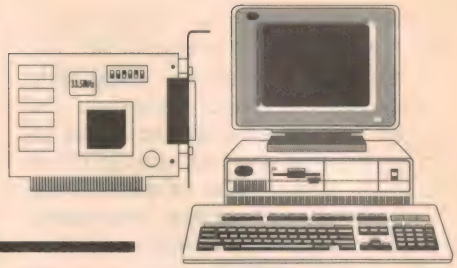
Good points: Fast, new analysis functions are friendly and easy to use.

Bad points: The EDA price is significantly more than version 5. The only difference between them is eight analysis options and more components.

RRP: $1599 for the EDA package, and $499 for version 5.

Available: Emona Instruments, PO Box 15, Camperdown, NSW 2050; phone (02) 9519 3933 or fax (02) 9550 1378.

Computer News and New Products



7GB IDE hard drive

Maxtor has released its new DiamondMax 1750 line of hard disk drives, with capacities of 7, 5.2, 3.5 and 1.7GB. The 7GB drive is said to be the highest capacity Enhanced IDE drive currently available. The 1750 series will be the first Maxtor drives available with the new UltraDMA support that doubles the burst transfer rate for ATA/IDE drives to 33MB per second. It also provides greater system throughput and maintains backward compatibility.

Other features include new 3.5 inch drive mechanics and electronics architecture; Formula4, Maxtor's new four-disk head disk assembly; magneto-resistive (MR) heads and a DSP-based architecture. The drives also have ANSI ATA-4 Enhanced IDE compatibility; a 256K cache buffer; custom on-the-fly error correction code logic, capable of correcting multiple error bursts without performance loss; low power consumption and a mean time between failure (MTBF) rating of 500,000 hours.

For further information circle 160 on the reader service coupon or contact Maxtor Disc Drives P/L, Suite 103, 55 Grafton Street, Bondi Junction 2022; phone (02) 9369 3662.

Digital gauge adaptor draws graphs

The Australian electronics company Microconsultants has developed a device which translates readings from a digital measuring gauge directly into graphs, thereby giving an easy means of alerting potential quality problems. The electronic interface is called GaugeLink, and is a low cost adaptor which connects any Mitutoyo digital gauge directly to a PC or notebook computer. It is easy to install, costs $139 and comes with Windows-based software. An optional footswitch ensures reading accuracy in awkward situations.

Using current industry standard statistical process control (SPC) technology, the software (qCalc) has a tutorial that shows how to detect unexpected process variations before they cause productivity problems. The device converts data into a standard format which can be read by most software packages, while qCalc offers manual or automatic data entry, control charts with adjustable control limits and flexible data range selection.

For further information circle 161 on the reader service coupon or contact Microconsultants (Aust) P/L, 2/12 Peninsula Blvd, Seaford 3198; phone (03) 9773 5082. Web site **http://microconsultants.com.**

A2 photo quality inkjet

The Stylus Color 3000 colour inkjet printer is an addition to Epson's wide format printer range and incorporates Epson's PerfectPicture Imaging System. It is a full four-colour, high speed, 1440 x 720dpi inkjet printer capable of producing printouts from A6 to A2 in size (maximum printable area 410mm).

The PerfectPicture Imaging System is a proprietary system that combines Epson's Micro Piezo technology, QuickDry Inks and AcuPhoto Halftoning technology. The new printer uses four separate large capacity ink cartridges, said to give economical operation. The new printer driver software interface provides on-screen indications such as the printing status, the page number being printed (when using the auto sheet feeder), paper size and level of ink left in the cartridges.

With the built-in banner paper holder and Epson's new media in a roll format, the new printer suits applications such as CAD drawings, banners, spreadsheets, single-sheet business forms, signage, business graphics, presentations and photographic images. The new media includes Epson's photo quality inkjet paper (A2 x 15 metre roll), special canvas cloth (three metre roll) and inkjet backlight film in A3 and A2 size. An optional banner cutter is also available. The RRP of the printer is around $3,500.

For further information circle 166 on the reader service coupon, see your local Epson dealer or contact Epson Australia, 70 Gibbes Street, Chatswood 2067; phone (02) 9903 9000. Internet **http://www.epson.com.au.**

16 channel analog DAQ input modules

IOtech has announced the release of the DBK53 and DBK54 16-channel programmable analog input modules. These are the company's latest additions to its series of signal conditioning and expansion products for the DaqBoard, DaqBook and Daq PCMCIA Card PC-based data acquisition systems.

Each module has sixteen differential analog channels which can be individually programmed to specific ranges. The DBK53 low-gain module offers programmable gains of x1, x2, x4, and x8; the DBK54 high-gain module offers programmable gains of x1, x10, x100, and x1000. When the modules are combined with the on-board ranges of the Daq family of products, a wide selection of full-scale inputs are available.

Both modules feature BNC input connectors, and up to 16 modules can be connected to one DaqBoard, DaqBook, or Daq PCMCIA card data acquisition system for a total of 256 differential inputs.

For further information circle 162 on the reader service coupon or contact Scientific Devices Australia, PO Box 163, Oakleigh MDC 3166; phone (03) 9579 3622.

Computer controlled watering system

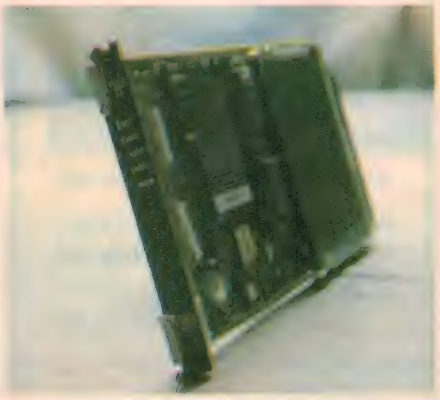
The new PC Control system from Fairhaven Nursery is designed to automate garden and nursery watering. The system consists of software written for Windows 95 (also runs under Windows 3.1 and 3.11), a control box that plugs into the parallel port of a computer and a 24V AC power pack. Software is also available that will run under DOS.

The DOS version will run on virtually any computer with a minimum of 2MB of RAM, and the Windows version needs at least 4MB of RAM. With more memory, several copies of the program can be run at the same time, with a control box for each available parallel port increasing the number of switches or solenoids that can be controlled.

Up to 48 stations can be controlled per control box, using water distributors such as those available from Nylex. Each station can be pre-programmed to water on a 24 hour, seven day cycle, and a date option can be activated to tell the system which day to operate up to a year in advance. A humidity sensor can be added for better control. The system can also be used to switch any appliance (TV, radio and lights) via an appropriate relay.

For further information circle 164 on the reader service coupon or contact Fairhaven Nursery, 497 Main Road, Montrose, Tasmania 7011; phone (03) 6272 8880.

Higher speed for Internet



U.S. Robotics has released a product which enables Internet service providers (ISPs) to download data at more than 48Kbps over normal telephone lines. The x2 enabled Netserver PRI (primary rate interface) card for the USR Total Control enterprise network hub combines the features of a terminal server and router with advanced security options, while providing support for both ISDN and analog services.

ISP customers can receive data at greatly increased speeds over a standard analog telephone network by using a USR x2 enabled modem or upgrading an existing USR modem to x2 56K technology. The server needs x2 enabled software on a primary rate capable Total Control rack. The rack can support multiple NETServer PRI cards and up to 60 modems in a single chassis, or up to 48 modems and up to 230 simultaneous ISDN connections across four PRI cards. The Netserver PRI card is available with Ethernet or Token Ring interfaces, and can also support frame relay with two independent high-speed synchronous ports.

For further information circle 167 on the reader service coupon or contact U.S. Robotics Pty Ltd, 473-479 Victoria Street, West Melbourne 3003; phone (03) 9482 6557.

Digital video grabber card

MuTech Corporation has introduced the M-Vision 1500, a single slot, 3/4 length, up to 16-bit (digital only) PCI bus frame grabber designed for high resolution/high speed digital, area and line scan cameras. The card takes inputs from 0 to 40 Mpixels per second. Pixel depths of 8/10/12/16 bits are handled. For 10 or 12-bit cameras, eight bits can be displayed in real time on a VGA monitor. The card can operate as a master or slave on the PCI bus and can achieve over 50 Mbytes per second sustained transfer speed in master mode. It is compatible with the new Pentium Pro as well as standard Pentiums and comes with 1Mb of dual ported VRAM with options of two or four Mbytes.

The card interfaces to a wide range of digital line and area scan cameras from Kodak, Pulnix, EG & G, Daisa, DVC, Fairchild, TEMET, Amber, and others.

For further information circle 168 on the reader service coupon or contact The Dindima Group, PO Box 106, Vermont 3133; phone (03) 9873 4455. ❖

WEBWATCH

presented by GRAHAM CATTLEY

WWW VL — Electrical Engineering

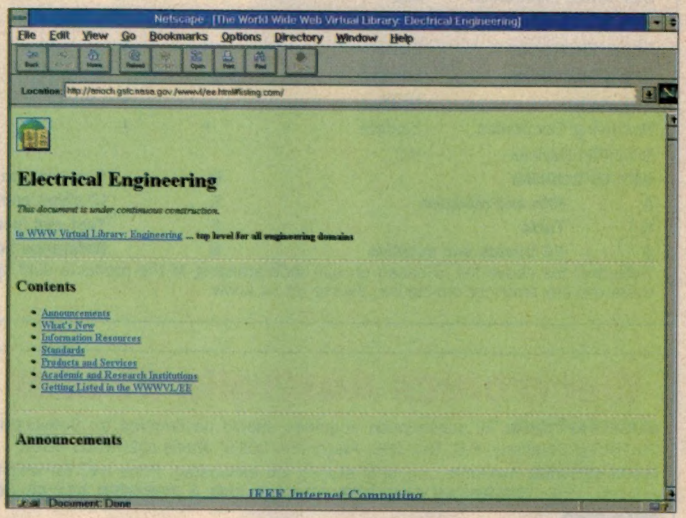
http://arioch.gsfc.nasa.gov/wwwvl/ee.html

The WWW Virtual Library is a vast collection of documents, papers and research notes published over a number of sites around the web. Each site maintains a list of documents in its own field, and as you might have guessed, the above address is that of the Electrical Engineering site which contains a wealth of information on the subject.

The site's various sub sections include engineering standards, engineering information resources, new products and links to a host of academic and research institutions like CERN.

There are also links to over 300 electrical engineering programs and a list of speciality links, like all of the high frequency sites around the world.

The page itself is perhaps a little dry, but you'll find that you can spend hours on it exploring the various links.



The Speaker Building Page

http://home.sn.no/~rpd/speaker/

If you are into hifi, thinking about designing your own loudspeaker cabinets, or worried about the finer points of hifi reproduction, then this is the site for you.

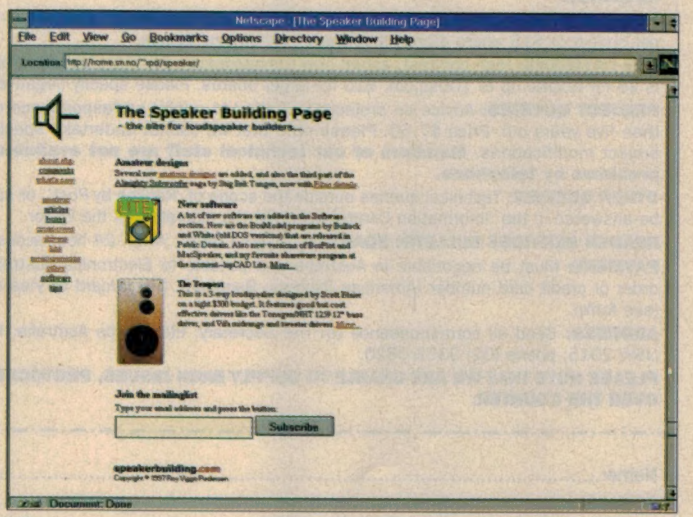
Aimed at mainly the amateur speaker builder, the site offers a lot of information that is hard to track down on the web.

Separate sections of the site are devoted to crossovers, boxes, drivers, amateur designs and there's even a 'hints and tips' page where you can read advice from other builders and designers around the world.

The site also contains references to heaps of software, both shareware and commercial, and lists over 30 loudspeaker software applications you can download for both PC and Mac systems.

As well, there are specialised articles on speaker building, including the third part of 'The Almighty Subwoofer' saga.

There are FAQs on design, general articles and so on, and if you are new to the site, they encourage you to join their mailing list for more info.

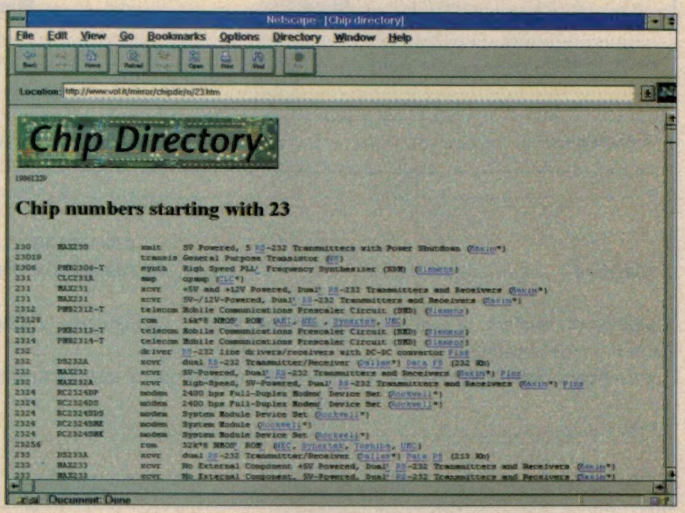


Chip Directory

http://www.vol.it/mirror/chipdir/chipdir.html

This site is, as you might have guessed, a chip directory that contains references to thousands of chips, all sorted by part number. You can log on and perform a search for a particular IC by part number in the numerically ordered listing, or use the chip search engine if your browser supports Java applications. If you want, you can download the entire site for your own use, and subscribe to the ChipDir mailing list as well.

There's too much more to list here and its all quite useful, so go and have a look for yourself. ❖



Come across any good sites that you think other readers would be interested in? If so, feel free to let us know — our email address is **electaus@magna.com.au**, so why not drop us a line?

EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
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Emona Instruments	NSW						•	
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KEY TO CODING

A	**Kits and modules**	**D**	**Components**
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C	**PC boards and supplies**	**F**	**Test and measuring instruments**
		G	**Reference books**

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Company, P.O. Box 199, Alexandria 2015; phone (02) 9353 9992.

BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**

PHOTOCOPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

READER SERVICES BULLETIN BOARD: (02) 9353 0627; ANSI, 24 hour access; any rate to 28.8kb/s.

PAYMENT: Must be negotiable in Australia and payable to Electronics Australia. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria NSW 2015; phone (02) 9353 0620.

PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

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ADVERTISING INDEX

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

BEST "VALUE FOR MONEY" CCD CAMERA

The best "value for money" CCD camera on the market! See us for a comparison to advertised cheaper models! We do not need to make you BEWARE! Tiny CCD camera, 0.1 lux, IR responsive, high resolution. This camera has a metal lens housing (not plastic) and performs better than many cheaper models. No surcharge for credit card orders! A pinhole lens version also available for the same price: $120 Yes, that's for just one camera and you don't need to be in a plan costing you thousands of dollars for quantity discounts: Just ring!! SALES TAX EXEMPT PRICE FOR EITHER CAMERA: $99. For different lenses, ring us!

Coming: A **lower priced** high quality standard or pinhole CCD camera. Quality product for under **$100**. Fax/ring or email for more info.

COLOUR CCD CAMERA - NEW

This high quality CCD camera is built over 3 boards which are joined with a flexible cable that can be folded into a very compact camera. Head board: 42x20.5mm, lens height: 24mm. Main board: 42x42x9mm. Power board 42x20.5x8.8mm. ***SPECIAL introductory price:*** **$350**, less with sales tax exemption.

KITS FOR CCD CAMERA SECURITY

New INTERFACE KIT FOR TIME LAPSE RECORDING: now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: **$25** for PCB and all on-board components, used PIR to suit: **$12**.

- **32mm 10 LED IR ILLUMINATOR** new IR (880nm) LEDs have an output about equal to our old 42 LED IR illuminator: **$18.**
- **32mm AUDIO PREAMPLIFIER** An **$8** kit that produces a 'line level' signal from an electret microphone, connect the output to our:
- **UHF VIDEO TRANSMITTER** (**$30**) or **$20** when bought with the camera. for a complete Audio-Video link.

32mm AUDIO AMPLIFIER: An LM380 based **$9** audio power amplifier which can directly drive a speaker — needs the 32mm preamplifier. *WHAT IS 32mm?* All boards are 32mm dia, so you can house these kits in a plastic 32mm joiner: cheap plumbing part.

MINI TV STATION

Make your own mini TV station with this metal cased, commercial transmitter with telescopic antenna. Dimensions 123 x 70 x 20mm, 12V operation. Includes power switch, indicator LED, RCA audio and video connectors, twin RCA-RCA lead. Our 32mm AUDIO PREAMPLIFIER kit with electret microphone (**$8**), and a CCD camera completes the station. Transmitter: **$30.** When purchased with a CCD camera **$20**. Regulated 10.4V-500mA plugpack to suit: **$10**

SWITCH MODE POWER SUPPLIES

Modern design, compact (145 x 80 x 50mm), totally enclosed in a perforated metal case, 12VDC/2A and 5VDC/5A out: **$17**. The same power supply installed in a flat PC type white powder-coated metal box (380(L) x 365(W) x 55(H)mm) is also available: **$20**

DIGITAL IR/UHF DATA LINK

Coming soon. Data transmitter and receivers that use either infrared or UHF wireless links. UHF and IR receiver modules for simplicity. Different kits will allow serial, 4 bit parallel with security coding, and 14 bit parallel data transmission. Four different IR Rx-Tx kits in all. Ring or email for more information.

20A DC MOTOR SPEED CONTROL

Ref SC June '97, slightly modified, PCB and on-board components (with 2 power MOSFETS!), plus the flyback diode and capacitor needed across the motor: **$18**

GEARED MOTOR WITH MOTOR SPEED CONTROLLER KIT

Back in stock: Used 12V windscreen wiper motor plus the 20A speed controller kit listed above: **$30**

MAGNIFIERS / LOUPES

Jewellers eyepiece: **$3**, Twin lens loupes: 50mm **$8**, 75mm **$12**, 110mm **$15**. A set of 4: **$30.**

12V SLA BATTERY CHARGERS

Intelligent 13.8V / 650mA "plugpack" gel cel battery chargers. Has isolation transformer, electronic switching regulator, dual LED indicator: **$8.80**

BARGAIN ARGON LASER HEADS

Cheapest way to get a BLUE-GREEN LASER beam! These used argons have around 30mW output (may need a licence), 6 mth guarantee. Power supply based on a transformer with 80V @ 2A and 3V @ 20A secondaries. Ring or email for more info. Head only: **$250.**

HELIUM NEON LASER BARGAIN

Large 2-3mW He-Ne laser head plus a compact potted US made laser power supply. The head plugs into the supply, and two wires are connected to 240V mains. Needs 3-6V/5mA DC to enable. Bargain: **$100**

BOSSMAN ELECTRONICS

A new subsidiary company to OATLEY ELECTRONICS, for giving TAX EXEMPT PRICES to entitled organisations. Product range will increase rapidly.

Phone (02) 9584 3562

TO-3 TRANSISTORS IN 1kg BAGS

Approx 1kg of semiconductors recovered from working equipment. All devices are in a TO-3 package. Approx 80 devices per kg. Wide variety of type numbers, some are common transistors, voltage regulators, and Shottky diodes. Have been poorly stored and have bent pins etc. **$6**

SUPER BRIGHT BLUE LEDS

BY FAR THE BRIGHTEST BLUE EVER OFFERED, super bright at 400mCd: **$1.50** ea or **10 for $10**

5mm LEDS AT SUPER PRICES

- 1Cd red: **10 for $4**
- 300mCd green: **$1.10** ea. or **10 for $7** (*make white light by mixing the output of red green and blue*)
- 3Cd red: **$1.10** ea. or **10 for $7**
- 3Cd yellow (small torch!) also available in 3mm: **10 for $9**
- Super bright flashing LEDs: **$1.50** ea. or **10 for $10**

NEW ICs

- CA3140 — MOSFET I/P opamp: **5 for $5**
- TL494 — switchmode power supply IC: **5 for $5**
- NE555 — timer IC: **10 for $5**
- ICL7106 — LCD display driver: **$5**
- CL7107 — LED display driver: **$5**
- IRFZ44 MOSFETS: 60V, 0.028 ohm on-resistance, 50A: **10 for $3**

MORE BITS AND PIECES

- **PHOTO TRANSISTORS** Enclosed in clear 5mm housing (like a 5mm LED), 30V/3us/<100nA dark current: **$1.30** or **10 for $9**
- **MIDRANGE SPEAKERS** 5" sealed back, 8 ohm: **$2** ea. or **10 for $15**,
- **CONE TWEETERS** 3" sealed back, aluminium cone: **$3** ea **10 for $20**
- **BARGAIN PLUGPACK** Large 13.8V DC/1A: **$12**

USED PIR MOVEMENT DETECTOR

Commercial quality 10-15m range, used but tested and guaranteed, have open collector transistor (BD139) output and a tamper switch, 12V operation, circuit provided: **$10**

AMPLIFIER - PREAMP AND MORE

A professional mostly SMD PCB with a 5W amplifier based on a TDA1905 IC, and a separate audio preamp. We also include a prewired high quality unidirectional electret mic with wind filter and mounting clip, a small speaker and hook up info. Probably from a communications system. Great for many applications such as a two way intercom that doesn't require switching (needs 2). Less than the cost of the electret mic. **$15 ea, 2 for $24.**

FAX POLLING

Back by popular demand. Poll (02) 9570 7910 for our list of items. Updated every month.

12V - 2.5W SOLAR PANEL KIT

Amorphous solar panel and glass backing: SPECIAL **$20** ea, **4** for **$60**

SOLAR REGULATOR

Ref: EA Nov/Dec 94 (intelligent battery charger). Efficiently charge 12-24V batteries from solar panels, but can also be used with simple car battery chargers to prevent overcharging. Very high efficiency due to MOSFET switch and Shottky diode. 7.5A or 15A kit: **$26/$29** (K09)

MASTHEAD AMPLIFIER KIT

Our famous MAR-6 based masthead amplifier. 2-section PCB (so power supply section can be indoors) and components kit (K03) **$15.** Suitable plugpack (PP2): **$6** Weatherproof box: (HB4) **$2.50**. Box for power supply: (HB1) **$2.50** Rabbit-ears antenna (RF2) **$7** (MAR-6 available separately)

PC POCKET SAMPLER KIT

Data logger/sampler, computer controlled chart recorder, slow speed scope. Incredible value value **$25**

WOOFER STOPPER Mk II

Works on dogs and most animals, PCB and all on-board components, transformer, electret mic & horn piezo tweeter: **$43**, extra tweeters (drives 4): **$7** ea Approved 12V plugpack (PP6) **$14 UHF REMOTE TRIGGER** Single channel Rx and Tx: (K77T) **$40**

IR REMOTE TESTER

Used blemished high res US night vision tube and a HV supply kit. Have either 25 or 40mm dia, fibre-optic coupled input and output windows. Use to test IR remote controls (without lens) or as a cheap IR viewer with lens: **$40**

5mW/650nm LASER POINTER KIT

YES, NEW 650nm kit. Very bright! Complete laser pointer that works from 3–4V DC. Includes 650nm/5mW laser diode, new handheld case 125x39x25mm, adjustable collimator lens, PCB battery holder: (K35) **$35**

DISCO LASER LIGHT SHOW PACK

The above 5mW/650nm kit plus our AUTOMATIC LASER LIGHT SHOW: **$99**

650nm LASER POINTER SPECIAL

Light weight 2 x AAA pen-size pointer with 650nm laser, very bright: **$55**

650nm LASER MODULE

Our new module has a 650nm laser diode. Very bright! **$50**

VISIBLE LASER DIODE MODULE KIT - COMING SOON

Same circuit as our "visible laser diode kit" but a smaller PCB (25 x 50mm, WxD) that fits into tubing. 650nm/5mW laser diode, 3V: **$29**

NICAD CHARGER & DISCHARGER

Professional, SMD switch mode, assembled and tested NICAD battery charger/discharger PCB assembly. For fast-charging 7.2V AA nicads. Basic info provided, plugpack not included. *Bargain:* **$9** ea or **3 for $21**

SOLID STATE PELTIER DEVICES

12V 4.4A, can be used to make a thermoelectric cooler - heater. Basic info included: **$25** 12V DC fan: **$8**

NEW COMPUTER CONTROLLED STEPPER MOTOR KIT

Coming soon. Similar to our previous stepper motor kit but with improvements so larger motors can be driven more efficiently, with much reduced loading on the computer's parallel port, and 2.5KV opto-isolation between the stepper driving circuit and the computer. Previous purchasers can contact us for a simple modification to greatly reduce the loading on the computer's parallel port. PCB and all on board components kit plus software and information: **$39** or with two M35 motors: **$49**

NEW FOR EXPERIMENTERS

- LASER PRINTER SCANNER ASSEMBLIES. Polygon scanner with driver circuitry, optics, 5mW/780nm infrared laser diode with collimator assembly etc. Basic info: **$29**
- BAR CODE READERS: **$65,**
- 640x400 Sharp LCDs, with back lighting strip!! Defective (most missing a few pixels): **$18**
- 576x550 CCD matrix: **$30**

VALVES

Unused, boxed: 6J7, 6J6, 6AV6, 6D4. Any mixture of **10 for $20**.

480 x 128 LCDs

Hitachi LM215 dot matrix liquid crystal display. CLEARANCE PRICE: **$15** ea **3 for $35.**

12V GEL BATTERY BARGAIN

Guaranteed Panasonic '94 date code 12V gel batteries! New, 2.3Ahr, 180 x 80 x 22mm, 0.67kg, as used in video equipment etc. **$10 ea.** That's a bargain but! **Two** batteries and an SLA charger: **$20!**

OATLEY ELECTRONICS

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1 watt amplifier family, 10 MHz to 4.2 GHz

Now is the time to rethink your design decisions—if you require up to 1 watt output for low-distortion intermodulation testing…broadband isolation…flat gain over wide bandwidth—or if you need much higher output level from your signal/sweep generator or frequency synthesizer—you can now specify Mini-Circuits' new ZHL Series, power amplifiers

Using ultra-linear Class A design, these state-of-the-art amplifiers provide up to 40 dB, flat (±1.0dB), are unconditionally stable, include overvoltage protection, and can be connected to any load impedance without amplifier damage or oscilation.

One week delivery…and, of course, one year guarantee.

SPECIFICATIONS	ZHL-42	ZHL-4240	ZHL-42-W	ZHL-424OW
Frequency, GHz	.07 to 4.2	.0.7 to 4.2	.0.01 to 4.2	.0.01 to 4.2
Gain, dB min.	30	40	30	40
Gain Flatness, dB	±1.0	±1.5	±1.5	±1.5
Power Out @ 1 dB CP, dBm min	+29	+29	+29*	+29*
VSWR in/Out, max.	2.5:1	2.5:1	2.5:1	2.5:1
Noise Figure, dB typ	10.0	4.0	8.0**	8.0**
Power Supply, V/ma	+15/690	+15/700	+15/750	+15/850
Third Order Intercept, dBm min.	38	38	38	38
Second Order Intercept, dBm min.	48	48	48	48
Size, in.	7 x 3¼ x 2⅛ h.	7 x 3¼ x 2⅛ h.	7 x 3¼ x 2⅛ h.	7 x 3¼ x 2⅛ h.

*+ 28 dBm, 10 MHz to 700 MHz, 3500 MHz to 4200 MHz
**Below 100 MHz increases to 15 dB at 10 MHz

READER INFO NO.24

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